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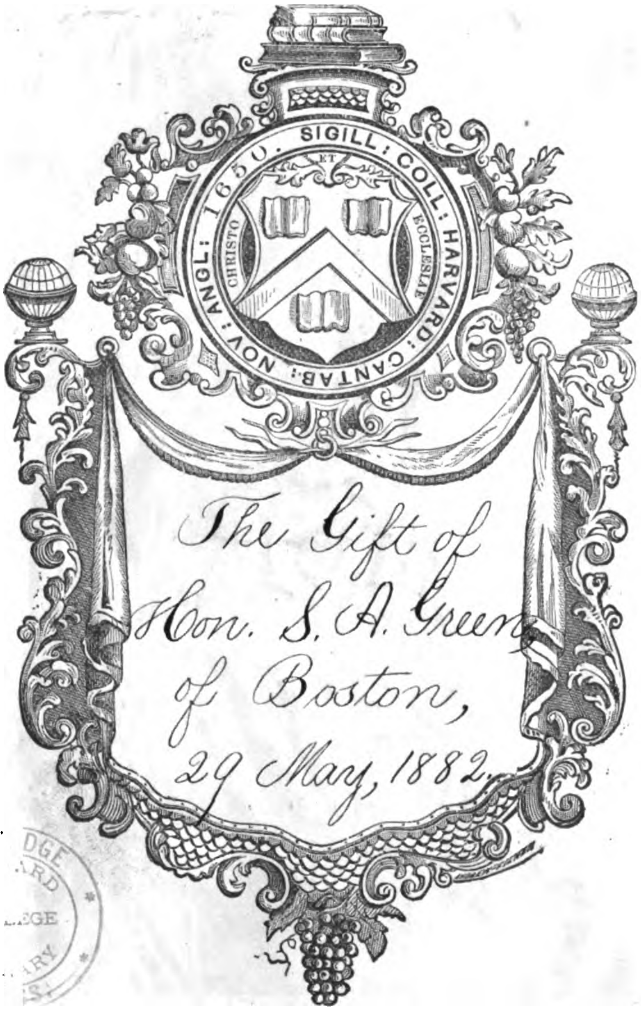
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CHRISTO ET ECCLESIAE

The Gift of
Hon. S. A. Green
of Boston,
29 May, 1882.

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State of Connecticut.

FOURTEENTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

Connecticut Board of Agriculture.

1880-81.

Printed by Order of the Legislature.

HARTFORD, CONN.:
Press of The Case, Lockwood & Brainard Company.
1881.

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MAY 29 1882

Gift of
Hon. S. A. Green,
of Boston.

To the General Assembly of Connecticut:

In accordance with the provisions of the Act creating a STATE BOARD OF AGRICULTURE, I have the honor to present the Report for 1880–81.

T. S. GOLD, *Secretary*.

WEST CORNWALL, January 5, 1881.

STATE BOARD OF AGRICULTURE.

1880-81.

HIS EXCELLENCY **CHARLES B. ANDREWS**, *ex officio*.

APPOINTED BY THE GOVERNOR AND SENATE.

		TERM EXPIRES.
E. H. HYDE,	Stafford,	1882.
ALBERT DAY,	Brooklyn,	1881.
H. L. STEWART,	Middle Haddam,	1882.
J. T. ROCKWELL,	West Winsted,	1881.

ELECTED BY THE AGRICULTURAL SOCIETIES.

Hartford County,	L. S. WELLS,	New Britain,	1882.
New Haven County,	J. J. WEBB,	Hamden,	1881.
New London County,	JAMES A. BILL,	Lyme,	1881.
Fairfield County,	B. K. NORTHROP,	Ridgefield,	1882.
Windham County,	RALPH W. ROBINSON,	Hampton,	1882.
Litchfield County,	C. T. HICKOX,	Watertown,	1882.
Middlesex County,	J. M. HUBBARD,	Middletown,	1881.
Tolland County,	WILLIAM HOLMAN,	Tolland,	1881.

ELECTED BY THE BOARD.

T. S. GOLD, West Cornwall, *Secretary*.

OFFICIAL LIST.

Governor CHARLES B. ANDREWS, *President*.

E. H. HYDE,	Stafford,	*Vice-President.*
T. S. GOLD,	West Cornwall,	*Secretary.*
NATHAN HART,	West Cornwall,	*Treasurer.*
Prof. S. I. SMITH,	New Haven,	*Entomologist.*
Prof. W. H. BREWER,	New Haven,	*Botanist.*
Prof. S. W. JOHNSON,	New Haven,	*Chemist.*
P. M. AUGUR,	Middlefield,	*Pomologist.*

E. H. HYDE, T. S. GOLD, H. L. STEWART.
Commissioners on Diseases of Domestic Animals.

J. T. ROCKWELL, J. M. HUBBARD, H. L. STEWART.
Auditors.

REPORT.

The Thirteenth Annual Meeting of the Connecticut Board of Agriculture was held in Hartford, at the United States Hotel, Wednesday, January 14th, at 10 A. M., Hon. E. H. Hyde, Vice-President, in the chair.

Present, Messrs. Hyde, Holman, Webb, Stewart, Rockwell, Day, Bill, Hubbard, and Gold.

The Report of the Secretary was read and accepted.

Resolved, That a committee on credentials be appointed by the chair; committee, Messrs. Hubbard, Bill, and Day.

The committee reported as members elect Ralph W. Robinson of Hampton for Windham County; C. T. Hickox of Watertown for Litchfield County; L. S. Wells of New Britain for Hartford County, and Benjamin K. Northrop of Ridgefield for Fairfield County; of these Messrs. Robinson, Hickox, and Wells were present and acted with the Board.

The bill of Hon. E. H. Hyde was presented by the auditors for advice, and on motion of Mr. Rockwell,

Resolved, That the Board pay Hon. E. H. Hyde $240, for his services as cattle commissioner.

On motion of Mr. Hubbard,

Resolved, That the Board pay P. M. Augur, Pomologist, $100 for his services.

The Treasurer's Report was then presented and referred to the auditors.

On motion of Mr. Day,

Resolved, That a committee be appointed to wait on Governor Andrews and solicit his attendance in the afternoon; committee, Messrs. Day and Bill.

On motion of Mr. Rockwell,

Resolved, That the Board proceed to the choice of officers. Messrs. Stewart and Wells were appointed tellers.

His Excellency Charles B. Andrews being *ex officio* president of the Board, the list was filled as follows:

Hon. E. H. Hyde, Stafford, Vice-President.
T. S. Gold, West Cornwall, Secretary.
N. Hart, West Cornwall, Treasurer.
Prof. S. W. Johnson, New Haven, Chemist.
Prof. W. H. Brewer, New Haven, Botanist.
Prof. S. I. Smith, New Haven, Entomologist.
P. M. Augur, Middlefield, Pomologist.
E. H. Hyde, T. S. Gold, H. L. Stewart, Commissioners on Diseases of Domestic Animals.
J. T. Rockwell, J. M. Hubbard, H. L. Stewart, Auditors.

Adjourned to 2.30 P. M.

The Board met according to adjournment, Hon. E. H. Hyde in the chair.

The Report of the Treasurer having been approved by the auditors, was accepted.

T. S. Gold was re-elected as member of Board of Control of the Agricultural Experiment Station for a term of three years.

The Report of the Cattle Commission was then read and accepted.

After discussion upon the work of the commission, it was

Resolved, That the Cattle Commission be authorized to employ veterinary assistance at their discretion.

Resolved, That Messrs. Rockwell, Gold, Hyde, and Wells be a committee to arrange time, place, and subject for the next winter meeting.

Mr. Wells presented an invitation from New Britain, that the next meeting might be held there.

The Secretary asked instruction about obituary notices in the report and was directed to omit such notices.

The Board adjourned to 7.30 P.M.

The Board met according to adjournment, and were favored with the presence of His Excellency Charles B: Andrews.

The Committee on Trial of Dairy Implements made their report, which, after a discussion of various plans, was accepted, and the Committee discharged.

The work of the Cattle Commission was then discussed at length, and it was

Resolved, That a committee be appointed to apply to the General Assembly for additional powers to enable the Commission more effectually to control contagious diseases in domestic animals.

Messrs. Webb, Bill, Rockwell, and Robinson, were selected as Committee.

Resolved, That the President and Secretary be a committee to arrange for visiting Fairs.

At the suggestion of Gov. Andrews, there was a discussion upon plans to maintain and increase our farming population.

Various plans were suggested for inducing immigrants to visit and locate in the State, but no action was taken. It was made to appear that Connecticut was a good place to come to as well as to go from.

The Board then adjourned *sine die*.

T. S. GOLD, *Secretary*.

WEST CORNWALL, Jan. 14, 1880.

The delegates to fairs were arranged as follows:

STATE FAIR at Meriden, Sept. 21–24. T. S. Gold, delegate.

HARTFORD COUNTY, Messrs. Rockwell and Bill.
  Hartford, Sept. 28, Oct. 1.
  Suffield, Oct. 14, 15.
  Pequabuck,—Bristol.
  Simsbury, Oct. 6, 7.
  Union, Enfield, Somers, etc., Oct. 6.
  Bloomfield, Oct. 8.
  East Granby.

NEW HAVEN COUNTY, Messrs. Wells and Hickox.
  At New Haven, Oct. 6–8.

Milford and Orange, at Milford, Sept. 8-9.
Guilford, Sept. 28.
Waterbury, Sept. 21-22.
Woodbridge and Bethany, Sept. 29-30.

NEW LONDON COUNTY, Mr. Webb.
At Norwich, Sept. 28-30.

FAIRFIELD COUNTY, Messrs. Day and Robinson.
At Norwalk, Sept. 14-17.
Danbury, Oct. 6-9.
Union, Monroe, etc., Sept. 21-24.
Ridgefield, Sept. 21-24.

WINDHAM COUNTY, Mr. Holman.
At Brooklyn, Sept. 21-23.
Woodstock, Sept. 14-16.

LITCHFIELD COUNTY, Messrs. Stewart and Northrop.
No Fair.
Woodbury Union, Sept. 15, 16.
Housatonic, at New Milford, Sept. 28-Oct. 2.
Watertown, Sept. 28-30.
Union, at Falls Village, Sept. 14-16.
Torrington, at Wolcottville, Oct. 14, 15.
Harwinton, Oct. 5.

MIDDLESEX COUNTY.
No Fair.
Clinton, Sept. 29.

TOLLAND COUNTY, Mr. Augur.
At Rockville, Sept. 22, 23.
Tolland County East, Stafford Springs, Oct. 6, 7.
Hon. E. H. Hyde, delegate at large.

A special meeting of the Board was held at the United States Hotel, in Hartford, April 14, 1880, Hon. J. J. Webb in the chair.

The subject brought forward by the Secretary was the resolution of the General Assembly appropriating $500 to the Board of Agriculture for the dissemination of information on the agricultural resources of the State.

Various plans were presented and discussed, resulting in the following resolution:

Resolved, That the Board appropriate $150 to Mr. John C. Dillon for lectures, and expenses incurred in disseminating information in regard to the agricultural advantages of the State, provided he will undertake the work.

The Secretary presented a letter from Gen. F. A. Walker, Superintendent of the Census, and, on motion of Mr. Rockwell, it was

Resolved, That the Secretary be directed to ascertain at what time the census relating to agriculture in Connecticut can be obtained for publication in the Report.

Adjourned to 2 P. M.

The Board met according to adjournment, Hon. E. H. Hyde in the chair.

The resolution in regard to Mr. Dillon was taken up and passed, also, as follows:

Resolved, That Mr. Dillon be requested to report to the Secretary from time to time the business placed in his charge, with a detailed report at the close.

Resolved, That a sum not exceeding two hundred dollars be placed at the control of the Secretary, to be used in collecting agricultural information.

The full Board were present, except Gov. Andrews and Messrs. Holman and Northrop.

The Board adjourned to the call of the Secretary.

A meeting of the Board, at the call of the Secretary, was held at the Humphrey House, in New Britain, Tuesday, December 14th, at 8 P. M., Hon. E. H. Hyde Chairman.

Present, Messrs. Hyde, Day, Wells, Robinson, Holman, Webb, Hubbard, Stewart, Bill, and Gold.

The report of the last meeting was read and approved.

The report of Mr. John C. Dillon was presented by the Secretary, and it was ordered that the expenses of Mr. Dillon should be paid by the Secretary.

REPORT OF MR. J. C. DILLON.

WALLINGFORD, CONN., July 10, 1880.

To T. S. GOLD, Esq.,
Secretary of State Board of Agriculture.

Dear Sir:

Sadly remembering the doom of the unprofitable servant, who returned his talent unused and unimproved, I resign my claim to the sum of a hundred and fifty dollars ($150) appropriated to my use at the meeting of the Board on the 16th of April last, because, on a careful examination of the field of labor, I could not see a probability of fairly earning it.

At the meeting alluded to, I stated that my success would depend materially on the support and assistance which my family and friends might or might not be disposed to accord me.

I regret to find that their interests and their convictions are decidedly opposed to emigration, and, outside of their influence, it would have been scarcely possible, with the time and means at my disposal, to have accomplished results materially beneficial to the commonwealth or satisfactory to the Board of Agriculture.

I might, of course, have tried, and might have produced such evidence of exertion as would have justified you in awarding me the sum appropriated. I had, in fact, prepared a lecture setting forth the advantages of Connecticut as a field for emigration; but, on mature consideration and consultation with gentlemen of judgment and experience, I was convinced that it would be unwise, and even unfair, to encumber, by a feeble and probably futile experiment, any efforts which the State or the Board of Agriculture might hereafter think it advisable to make.

The following are a few of the obstacles which must be met and overcome in recommending Connecticut as the land of promise to the British farmer:

There are no lands to be given away, and the fact that owners will sell for less than the value of improvements, is a strong argument against the intrinsic value of the land.

To the average English farmer, the cheap, rich, and level lands of the West offer a paradise of pastures and grain-fields; while the mere mention of fruit-culture and market-gardening, on which the New England farmer is learning more and more to rely, is pretty sure to remind him of a lot of cabbages and cauliflowers, pears, plums, and apricots, which, for want of experience, scarcely paid the cost of marketing.

It is not, however, the question of comparative advantages which the advocate of Connecticut has most need to fear. Indeed, the enquiries and comparisons I have made have tended to confirm my own convictions that the industrious farmer, with small or considerable capital, can find no better place to live, and no better people to live among, than in the New England States in general, and the State of Connecticut in particular.

The chief difficulty is, in securing the attention and overcoming the prejudices of the people we wish to influence.

In every newspaper, in every railroad station, in every hotel and tavern, and in almost every barber's shop and place of public resort in England, are flaming advertisements setting out the attractions of the Western States and Territories, Canada, the Cape of Good Hope, Australia, and New Zealand, and offering, free of charge, books and pamphlets in which the advantages of these locations are displayed in the most glowing colors, and supported by statistics from the most authentic sources.

It may be questioned whether the New England States have the same personal pecuniary interests to serve, and whether it will pay them to make the same exertions to induce immigration ; but it is certain that the class of immigrants which Connecticut wishes to attract is comparatively small and difficult to reach, and her advocate needs to be prepared with statistics and evidence, with which, in my hurried departure, I had neglected to provide myself.

I have, however, done what I could to promote the objects of my mission, and I have reason to hope that my efforts will, sooner or later, be productive of good.

I have spent about twenty-five dollars, in traveling and other expenses, in endeavoring to carry out my instructions ; and, while I make no demand, I respectfully submit the propriety of my reimbursement to the consideration of the Board.

And, with the world before me to choose from, I return, with increased love, to my adopted country, with increased gratitude and respect for the people and the institutions which make New England pre-eminently desirable and enjoyable as a home.

I have the honor to remain,
Dear sir, your obedient servant,
JOHN C. DILLON.

The Secretary reported his action in securing information about the agricultural advantages of the State, and was directed to embrace in the published report of the Board the report of Mr. Dillon, and the papers prepared by those employed by him, which are completed by the first week of the session of the General Assembly.

Adjourned to 10 P. M., Wednesday.

The Board met according to adjournment.

A letter was presented from J. T. Rockwell, stating his inability to be present, from illness, and Mr. Bill was chosen to act as Auditor.

Adjourned to 10 P. M., Thursday.

The Board met Thursday evening, according to adjournment, and passed the following resolutions :

Resolved, That the Cattle Commission be authorized to draw on the Treasurer for expenses incurred in their work, orders to be paid on presentation with proper vouchers.

Resolved, That the Secretary be authorized to draw on the Treasurer for the expenses of the winter meeting.

Adjourned to Friday, at 10 P. M.

The Board met at 10 P. M., and no business being presented, adjourned *sine die*.

T. S. GOLD, *Secretary*.

WEST CORNWALL, Dec. 18, 1880.

FARMERS' CONVENTION.

A Farmers' Convention, under the direction of the Board of Agriculture, was held at New Britain, December 15, 16, and 17, the general subject announced being, "What the Farmer ought to know, and how he may learn it." The meetings were held in the hall of the Humphrey House, and were, from the first, largely attended by representative farmers from all parts of the State.

The meetings commenced on Wednesday morning, December 15, at 10.30, Vice-President Hyde occupying the chair.

INTRODUCTORY ADDRESS.

BY HON. E. H. HYDE.

Gentlemen,—I welcome you to our annual meeting in this thriving and busy town with words of good cheer. The way before us looks clear and bright. I am free to say, as a veteran pioneer, with the experience and observation of forty years, that I have never known the great department of human industry, which we have the honor to represent on this occasion, to receive such careful and intelligent study, and such wise and enlightened administration in all its practical, as well as scientific details, as at the present time. It is receiving the close and zealous attention of men of the highest standing and culture, who are throwing upon it a light which falls, with more or less illumination, into every farm-house in the land.

Knowledge, that is fast coming within the reach of all men where the press sends its printed page, is making easy and attractive the old ways that once were slow and depressing, and it is pointing, as with a diamond, the plough-share that turns up through the ashes of worn out earth a virgin soil, and warms and quickens, as with the morning light, the chambers of the sleeping seed. The years of my life, as I look back upon them, seem to expand, and cover a century. Wider than the Atlantic seems the space between the old world of my youth and the world of to-day. Were I to be transported back into that other world, though the same skies would be above me, and the same hills around me, I should feel lost and lonely. There would be no great West, with its reapers and threshers, and boundless fields of wheat, home of the great cities that have sprung up as by magic; and where the iron roads stretch their vast length there would be only the trail of the Indian and the beaten paths of the deer and bison. Here, in New England, much would seem as new and strange to me as though I had but just been born into life. At home, in the house, or on the farm, I should constantly miss something that I had lost. The old primitive implements would be there; in the house, the small windows, and uncarpeted floor, the great fire-place and swinging crane; in the barn, old Dobbin, with his wall-eye and frowsy pate; and in the huckleberry-pasture beyond, the pig and goose-pond, old Brindle and the sheep.

I should feel as though I could touch, with my shortened and benumbed hand, the horizon of the world. The Bible and Farmers' Almanac would be immortal there, as here, but railroads, electric wires, complicated machinery, the great facts resulting from scientific expansion and experiment, books on all subjects relating to human life and labor, and the daily paper, that makes a thousand leagues as one, would have dropped out of my existence. Agriculture would be honorable, as it has ever been, for in all climes, and through all ages, it has justly borne the reputation of being the first of all mortal industries, taking rank even before the fig-leaf or the travail of the first woman. But I should find it in that other world of which I am speaking, a thing so primal and inherent in the common nature of things as to be left almost to run of itself, like the ever-going sun. Ever from the sun outpours the blessed heat and light, and through the toil of agriculture come the bread, and meat, and wine without which humanity would wither away and perish! But while in that other world the sun would be shining as blithely as to-day, and sewing as deftly with its threads of gold the seams in the emerald robes of our good Mother Earth, and the procession of the seasons would be moving on in the unbroken harmony of the eternal order, I should find agriculture almost as primal, and quite as vital to man, as the sun and seasons, standing unexalted in the list of mortal necessities. There would be ships on the seas, and fishermen skirting every shore, and miners digging deep for gold, and philosophers penetrating the secrets of nature, and the solemn mystery of the skies, but nowhere back in those old and yet not long gone days, should I find those wonderful contrivances of mechanism that have lifted from human labor its weary burden, or the enlightened skill with which the tiller of the soil feeds and trains his fields, and shapes the sinews of the horse, and the flowing udder of the cow.

Gentlemen, all of the great commingling interests of the country have received since our last annual meeting a reviving and quickening influence. The year that is now closing will pass into happy remembrance. It will be called to mind and contemplated in future times as marking an epoch in the history and growth of our industries, and in the broadening of new fields and avenues of labor and trade. A fresh and auspicious impulse has been given to foreign immigration. Tens of thousands of hardy, industrious men, not unskilled in the culture of the soil, have flocked in upon us from Northern Europe, with their wives and children, and sped on, without tarrying at our ports, to take up unbroken lands in the West. Whole colonies of such valuable agricultural reinforcements are now in the course of formation. In return, we have exported to new-found markets in the old world a vast volume of our varied productions.

The harvests of this splendid year are without precedent. The statistics of our great leading crops seem almost incredible. More than this, the year has afforded us, in our great quadrennial election, a sublime illustration of the stability of our institutions and the pacific spirit of our people. Although important and conflicting interests were deemed at stake, and public opinion ran high in opposite channels, and though the two great national parties were so nearly balanced that to this date it is not known which canvassed the largest popular vote, more than ten millions of freemen cast their ballots at the hustings, and returned quietly to their daily avocations, ready to abide the vast result in peace and contentment.

We have extended an invitation to the Normal School to come and hear the lecture by Prof. Northrop, and the invitation has been accepted.

We have with us this morning the distinguished gentleman who has the educational interests of the State in charge.

It is now my pleasure to introduce to you Prof. B. G. NORTHROP.

WHAT SHOULD OUR SCHOOLS DO FOR AGRICULTURE?

BY PROF. B. G. NORTHROP.

FARMING is the leading and most essential business of the country, occupying more than three-fourths of our laboring population. It is the basis of the wealth, prosperity, and power of the American people. Its depreciation would demoralize the nation. It was the original, divinely-appointed calling of man. God planted a garden in Eden, and made it man's first duty to "dress and keep it." When driven from Eden, it was still his mission to "till the ground from whence he was taken, and to eat bread in the sweat of his face." The Creator plainly intended that Agriculture should be the ground-work of civilized society; the basis of all progress. On its prosperity hang the hopes of the race, far more than on any other calling. It must provide the means of sustaining an increasing population, or there can be no growth. Commerce and manufactures depend upon it more than it does upon them. In the words of Webster, "they all stand together like pillars in a cluster, the largest in the center, and that largest is Agriculture." For an interest so broad and vital to the prosperity of the whole country, our schools should accomplish the best possible results.

Now that slavery is abolished, we have no vestige of a caste system in America. Labor is honorable, and the laborer is honored. The most popular rallying-cry to help a candidate for the highest office is some term which affiliates him with farmers or other workmen, like "the rail-splitter," or "tow-path boy." In contrast with the distinct classes and hereditary nobilities of the old world, it is our proud national characteristic that we are a working people, that he is the noblest who works most and best for the general weal, and that the cause of the workmen is recognized as the cause of all. The best way to elevate farming is to elevate the farmer. The people are learning that mere muscle is weak, and that brains help the hands in all work, that knowledge and skill multiply the value and productive power of muscular efforts. Whatever the chemical analyses of our Experiment Station may show, the best of all fertilizers isbrains. In farming, as every where, if knowledge is power, ignorance is impotence. What a man *is*, stamps an impress upon what he does, on the farm or in the shop. The style of the work depends on the character of the workman. Whatever elevates the farmer ultimately improves his farming. Whatever degrades the farmer at once depreciates his work. The wealth and welfare of individuals and communities, always dependent on labor, can be most fully secured only by educated labor. You can dignify farming in no way so surely as by educating, and thus elevating, the farmer. As mind triumphs over matter, the amount of manual labor requisite to secure equal results constantly lessens. The future improvement of farming depends on brain as well as brawn. The progress of civilization has always been commensurate with man's dominion over nature, and his utilization of her forces and resources. "Subdue the earth and have dominion over it," was the primeval command. We gain that dominion over nature just in proportion as we *discover* and obey her laws. In struggles for material success, he wins who best wields physical forces.

To enable our schools to accomplish better results for agriculture, I invite our farmers to do more for the schools, and especially to visit them. We need a still higher appreciation of them, and a more active and intelligent interest in their improvement. Apathy on the part of parents would neutralize the efforts of the best teachers. The character of the schools in every place must answer to the local public sentiment. You stimulate public interest by improving the schools, no more surely than you improve the schools by elevating public opinion. The Legislature alone cannot create good schools. Right laws may accomplish much, but the people, once in earnest, will do more. In our rural districts, no class can so effectually advance this great interest of the people as the farmers.

The most essential service our public schools can render for Agriculture is to give all our youth a thorough training in the common English branches. These lay the foundation for success in all after work, whether on the farm, in the shop or store. The point of greatest weakness, even in our colleges, is found in the deficiency of their candidates in the elementary branches. Thoroughness here at the outset means thoroughness everywhere. The habits of accuracy, of application, of self-control, and self-reliance in overcoming difficulties, early formed in school, constitute the best preparation for the farm and all other callings of life. Far more thought and time and drill should be given to these simple elements. Rightly taught, they provide the truest discipline for the juvenile mind, and form the best basis for all future acquisitions. When we build the superstructure without a firm foundation, all is insecure. The first effort of the school is to lay the ground-work broad and strong. That done, and you create the desire and the skill to build up the edifice; that done, and school is a welcome place, and study becomes a pleasure; that done, and there follows such a hungering for knowledge that when one's school-days are ended he realizes that his education is but just begun, and for the rest, it shall be the aim and pleasure of his life to educate himself. Even though the milking may summon him early in the morning, and the chores detain him late at night, he will seek time and find time for the cherished work of self-improvement. Place him where you will, let his work press as it may, he will find leisure for reading, and occupy rainy days, the long winter evenings, and all intervals of labor in efforts for self-improvement. Even the odd moments thus utilized, in the end yield a large reward. The habit of utilizing these odd moments, and thus learning how to economize time as well as money, has most important moral bearings. The boy who thus early learns that "life is real, life is earnest," and makes the most of each passing hour, is gaining self-command and self-respect, high aims and purposes that lift him above temptation and give him the true farmer's self-poise and conscious independence.

To secure the best results for our farmers, I would advocate giving greater prominence to *reading*, which I have long regarded as by far the most important study taught in our schools. This is the surest way to the mastery of all higher studies. Early proficiency here fosters a fondness for books, while aversion to study springs from tasking youth in severer branches before they can read fluently. Let a child early learn to read with facility, and he has the key by which he can open any door in the temple of science. Isolated as the farmer's homes necessarily are, to a great extent, reading should be made the never-failing attraction of the long winter evenings. But when it is a toilsome process to spell out the words, there can be little pleasure in reading or interest in the narrative. It is the duty or rather the privilege of the farmer to see to it that his children are liberally supplied with attractive and wholesome reading, whether by the purchase or exchange of books, or by reading clubs, or by a town or district library. Whenever its importance is duly felt, some method of gaining the proper supply will be devised.

For the best results to our farmers, and to all industrial classes, less time should be given to the complex puzzles of arithmetic, and more to the simple ground rules. Master addition, subtraction, multiplication, division, percentage, and the keeping of accounts, and the rest which is of practical value is easily and quickly gained. Our arithmetics are too voluminous. Let there be more drill in rapid mental combinations and practical methods and principles, and less study of abstruse processes. Such topics as alligation, medial and alternate, and commutation of radix, and others as intricate and useless, may well be omitted in a common-school course. These and kindred topics, never applied in ordinary business, fill a large space in the arithmetics, and waste much precious time of the pupils. They have the sanction of tradition rather than of common-sense. In continuing them, teachers and authors have consulted usage more than utility. Like the titled scions of rank in the old world, they have come down by so long a literary descent that no one disputes their right to their honored place. Worth more than all these obsolete processes is the thorough mastery of the ground rules. Rapid mental combinations should be daily practiced, till pupils can add, multiply, and divide with the utmost rapidity and accuracy. The art of arithmetic will thus be mastered, though the profundities of the science be not explored. Ex-President Thomas Hill, of Harvard college, himself an eminent mathematician, strongly condemns the common practice of stupefying and disgusting pupils with premature attempts to understand arithmetic as a science, while, as a consequence, they fail to acquire facility in it as an art. Life is not long enough to spend so much time on the intricacies of compound proportion, permutation, and the like, that not one in a thousand ever applies in business.

The public school should train our youth in habits of *observation*, which is the prime secret of success in farming, and forms the true basis of all higher education. The child's intellectual life begins with impressions from the senses, which are the windows of the soul. The noblest of these, and the royal avenue to the mind, is the eye. This sense-education commences in the cradle, and should continue through life. Hence, "Things before names, ideas before words," and, in higher stages, "Principles and processes before rules," should be the motto. Too often the teacher begins with books and continues with books only, teaching that which is impractical, if not incomprehensible, to the neglect of things nearest at hand, things most interesting, suggestive, and useful. God designed nature to be the earliest and most constant teacher of the juvenile mind, and has made objects and events the leading instruments of developing the faculties. Invaluable as are books, they are but the art of man, while nature is the art of God. It is therefore a narrow view of education that makes books its only instruments. Every device should be employed to foster love of nature, and form habits of careful observation of common things. The organs of sense, when not early trained, become rigid and unimpressible. The teacher who relies upon the text-book alone is more than three thousand years behind Job, whose maxims deserve a place in the most modern didactics. "Ask now the beasts, and they shall teach thee, and the fowls of the air, and they shall tell thee; or speak to the earth, and it shall teach thee; and the fishes of the sea shall declare unto thee." Such a teacher forgets the motto of the wise man, who said, "Go to the ant, thou sluggard; consider her ways and be wise," or that of the Great Teacher, who said, "Consider the lilies of the field, how they grow," and "Behold the fowls of the air." Milton well says, "To know those things which about us lie in daily life is the prime wisdom."

I commend to our farmers' boys the advice given to youth by Hugh Miller: "Learn to make a right use of your *eyes;* the commonest things are worth looking at, even stones, weeds, and the most familiar animals. One of the best schools I ever attended was the miscellany of objects and circumstances surrounding me in my native district, challenging the first exercise of my senses and fancy, and this is a species of education open to all." True, but how few are open to it. How many go through the world practically blindfolded. Under the lead of his uncle Sandy, the keen-eyed harness-maker, Hugh Miller, while a boy, had observed carefully the rocks, rains, tides, trees, ferns, shell-fish, sea-fowl, and insects along the rocky shore of his native Chromarty. While working seventeen years as stone-mason in the quarries or sheds, he studied the stones he was hammering, and thus became the most eminent geologist of his age. So, in general, the most distinguished men of all ages and countries have been close students of nature and observers of common things.

I have emphasized this subject because the careful observation of nature's processes is specially essential to the success of the farmer. Unless acquired early, the habit is not likely to be ever formed. This work cannot be done by proxy. The judgment of the farmer must be based on his personal observations. Indispensable as is the knowledge gained from books, its use and application depends on one's own study of things. The failures of fancy farmers come from following book theories without that adaptation to changed local conditions which personal observation and experience alone can suggest. Hence, both in the family and school, curiosity should be so stimulated as to prompt an insatiable desire for that knowledge which comes through the senses when trained in observing the qualities of common things. Curiosity, or, what is kindred, love of knowledge, is one of the strongest natural desires of the child. Though too often dwarfed by our blundering, when the senses are sharpened it is one of the most vital forces in education, becoming the parent of perception and attention, of memory, imagination, and expression. It prepares the soil and fertilizes the seeds of truth. A farmer might as well sow a field without plowing as a teacher instruct'pupils in whose minds no love of knowledge has been awakened. Strong in childhood, it should grow with years and attainments. Though at first a restless instinct, it should mature into a ruling passion. Curiosity is to the mind what appetite is to the body. It creates a hungering for knowledge, which is the mind's food. Love of truth was as strong a passion with Newton or Agassiz as love of conquest with Napoleon. Under its healthful inspiration, study is a pleasure,—without it, a task; the dullest drudgery, "a weariness of the flesh." Curiosity is the primal desire to which the child's nature responds; it is the impelling power to which genius, when enriched with the treasures of science, is most susceptible. The amplest supplies only add fuel to the flame. Instead of surfeit, there comes an intenser craving for more. Each new attainment gives strength and stimulus for higher acquisitions. To show how susceptible is the plastic mind of childhood when consciously brought into contact and sympathy with Nature, by a teacher competent to be her interpreter, I mention two out of a multitude of similar illustrations. An eminent botanist narrated to me the following personal incident: "When I was a mere boy, my teacher, handing me a flower, asked me to notice *all* its parts, and when I had done so, for the first time in my life, he gave their several botanic names, introducing each with its Saxon synonym, which I never forgot. That brief talk of twenty minutes inspired me with an interest in observation and study that led to collegiate culture." Said another gentleman, author of popular text-books on Natural History: "My teacher once invited me to search on my father's farm for curious stones. I found a white stone, with sharp edges, of which he said, 'That is a good specimen, though very common, for three-quarters of the earth's crust is made up of this stone. It is very useful. The grains and grasses get the sharpness and strength of their stalks from a minute portion of this stone, which the rootlets dissolve and send up for their growth. It is useful also in the arts. You have it in the wall and common plaster. Glass is made of it, only a little stuff is mixed with it to make it work well, and the very best spectacle-glasses are made of pure specimens of stone like this,' showing me a pure quartz crystal, and pointing out its exact hexagonal form and pyramidal cap. That brief talk changed my history and fired my mind with love of learning."

The farmer's boys have the best opportunities of learning these practical lessons from nature, provided the teacher is competent to start them in the right lines of observation. On the farm, birds, insects, fishes, and all animals, flowers and foliage, plants, shrubs, creeping vines, and trees, to say nothing of the minerals under his feet, are all practical primary teachers.

In the interests of agriculture, and all industrial pursuits, our youth should be taught at school the necessity of *labor*, its vital relation to all human excellence and progress; the evils of indolence, and the absurdity of the common aversion to manual labor. This popular distaste for industrial pursuits should be *early* counteracted, and the silly and pernicious notions that labor is menial, and that the tools of the farm, or of a trade, are badges of servility, should be refuted in our schools, and more should there be said and done to dignify labor, and render industrial pursuits attractive and reputable. The agricultural, forestral, and industrial schools, so numerous in Germany, Switzerland, and other portions of Europe, have proved as efficient in dignifying labor as in increasing its efficiency and market value. Girls, as well as boys, are there early taught, both in the family and school, that to learn to be useful is alike their duty, privilege, and interest.

Many of our youth are afflicted with an ambition for easier lives and more genteel employments, and with the infatuation that city clerkships are the most eligible positions, while farming and the trades are not "respectable." Let them learn that the intelligent farmers or mechanics have a better chance of securing wealth, health, and influence than the over-crowded city clerkships can afford. In any average farming community, let twenty young men form a stay-at-home association, and employ their best skill in rural pursuits; and another twenty, we will suppose of the same capacity and education, start in quest of city clerkships, and at the end of twenty years I am confident our stay-at homes would, on the average, have better health, better character, greater influence, and more money than the twenty who turned their backs on the humble industries of the country.

Clerks are often paid less than skillful mechanics, and are less independent. In their precarious positions, they are liable to disappointments and humiliating struggles with the thousands of others "looking for a place." Every advertisement for a clerk brings a whole swarm of applicants. How pitiable the condition of this superabundance of book-keepers and exchangers, wasting their lives waiting for a place, while our farms and factories, railroads and trades, are clamoring for educated superintendents, foremen, engineers, skillful managers, and "cunning workmen." The position of the educated and well-trained farmer or mechanic is far preferable to that of average city clerks. The latter may dress better, talk more glibly, bow more gracefully, not to say obsequiously, but they compare unfavorably with our best farmers and mechanics in manly independence, vigor of thought, and strength of character.

Too many of our young men leave the homestead on adventures less safe and reliable than the arts of industry. A good trade is more honorable and remunerative than peddling maps, books, pictures, patent-rights, and clothes-wringers, or in a city store to be cash or errand-boy, store-sweeper, fire-kindler, or even book-keeper. Without in any way disparaging the useful position of the clerk, our young men may properly be cautioned against further crowding this already plethoric profession. To the boys in the country I say, instead of aspiring to an uncertain and precarious clerkship, stick to the farm, or learn a trade, and you will lay the broadest foundation for prosperity.

The value of work as an educator hitherto too little appreciated, needs to be taught in our schools. Children learn by doing. This principle underlies the whole Kindergarten system. Its prime motto is, "Do nothing for the child which he can be encouraged to do for himself." His planning, combining, constructing, and designing, with simplest materials, foster interest and skill in work. It would be a grand achievement if the public schools should lead our youth to realize that their education is essentially deficient until they have learned to work in some useful form of industry.

Such was the theory and practice of the ancient Hebrews, carrying out the plan given them from Heaven. That is plainly the Divine plan for the race. The Hebrews held that all children should be taught some handicraft as an essential part of education. Among them labor was always honorable. No man was ashamed of his trade. No matter what his rank, every one must be trained to work. The chief of the Apostles did not degrade his high office by occasionally resuming his trade of tent-maker. By his own example, he enforced his precept "if any would not work, neither should he eat," and sharpened his censure of "the disorderly busy-bodies working not at all." His associates never suspected that their old business of fisherman was disreputable. Why was it that the Great Teacher, when all possibilities were open to his choice, sought out the humble home of the carpenter and worked patiently at His reputed father's trade, except that He might condemn before the world the unchristian and heathenish notion that labor is menial. On the other hand, the Chinese Mandarins who let their nails grow as long as their fingers, to show that they never work, are the illustrous predecessors of the pretentious snobs who affect to despise the industrial arts.

The Jews still maintain their ancestral pride and faith in *work*. Notwithstanding long ages of bitter persecution, they are, as a race, most remarkable for perseverance, energy, and ability. These manly traits have been fostered by their hereditary habits of industry. Debarred by oppressive laws for many centuries from the ownership of land and from the ordinary industrial pursuits, they were driven to trade, which naturally continues to be their leading occupation, and in which they have gained marked success by dint of indomitable energy in the face of opposition and manifold difficulties. In his own life, as well as in Endymion, Beaconsfield has strongly illustrated the power of an indomitable will.

In every country, where the civil disabilities which oppressed them for so many centuries, have been removed, the Jews have soon risen to be leaders in education, in the press, in finance, in science and literature. Their wonderful ability and success seem to be the secret of the new and strange outbursts of mediæval intolerance and hostility which now disgraces Germany. The real trouble is, that the Jews so often outstrip their rivals and win the prizes which are open to fair competition. The complaints made in late German periodicals fully betray this unworthy motive. The outcry is "The Jews are monopolizing the best positions in the universities, absorbing millions of money, controlling exchange, becoming our leading capitalists, and even crowding into Parliament, and in danger of moulding the destinies of the nation."

It is a redeeming feature of this outburst of narrowness that the Crown Prince, who himself once thoroughly learned a trade, denounces the present persecution of the Jews as "a shame to Germany." No man in Germany has done more than he to make labor reputable. He has practiced as well as preached the gospel of work, having early learned the cabinet-maker's trade. At Babelsberg, near Potsdam, the summer palace of the Emperor of Germany, are shown choicest articles of furniture made by him. When his only sister, the Grand Duchess of Baden, placed her daughter in the *Schloss*, a famous school in Carlsruhe, she directed that she should be excused from none of the household industries required of the other pupils, that she should be trained in sewing and knitting, and made as thorough a seamstress as if she were expecting to earn her livelihood by her needle. Such royal examples of honoring industry have exerted a vast influence throughout the German Empire.

The tendency on the farm is to overwork the boys and allow too little respite for play, for with the young of all animals, play is the dictate of nature. The earth, the air and sea are full of animals who seem to luxuriate in playful activity. But, while all work and no play represses the jubilant impulses of childhood, the tendency of our times to all play and no work is far more harmful. Excessive amusements dissipate the mind, weaken the will, and demoralize the whole character—making one restless, selfish, discontented, and dependent. The habitual idler naturally degenerates into something worse, for idleness and vice are twins. Labor, though called the curse and consequence of sin, may be a blessing to beings constituted as we are. We need the spur of necessity to energize our minds. Our richest thoughts and experience, and our best discipline come to us when we are intensely active. Toils and privation seven, give strength, endurance, and courage for future achievements. The successful merchant who, with a fortune retires from business, and sits down to enjoy himself, with nothing to do but take his comfort, becomes the victim of ennuï, if not of dyspepsia.

Industry is essential to thrift and virtue, to mental, moral, and physical health. The Devil tempts everybody, but the idler tempts the Devil, who gives plenty of work to all whom he can find with nothing to do. The historian Froude, well says, "There are but three ways of living; by working, by begging, or by stealing; Those who do not work, disguise it in whatever pretty language we please, are doing one of the other two." Every man should have one vocation and as many avocations as he can. Men of mark are men of work. The most industrious individuals and races are the most intelligent and powerful; the most elevated morally as well as mentally. In whatever land man can subsist in indolence, he droops in intellect, and there is the greatest demoralization in those tropical climates where leisure rather than labor is the rule of life. Man rises in the scale where his necessities compel constant industry, as he sinks where his wants exact no labor. Where industry becomes habitual and skillful, it not only supplies mere necessities, but stimulates demands above absolute wants. Every pure enjoyment gained by labor, prompts the desire for other and higher gratifications. Theodore Parker said, "The fine arts do not interest me so much as the coarse arts, which feed, clothe, house, and comfort a people. I should rather be a great man as Franklin, than a Michael Angelo; nay, if I had a son, I should rather see him a mechanic who organized use, like the late George Stephenson, in England, than a great painter like Rubens, who only copied beauty." Edward Forbes says, "He who knows not what it is to labor, knows not what it is to enjoy."

I once began a census of the eminent men of Connecticut, those who have been most successful in business, or in the various professions, and found that the great majority of them had the discipline of rural occupations in their youth. The successive governernors of our State, for a long time, with a single exception, were early accustomed to manual labor. The town of Lebanon has raised up five governors. Many retired rural districts and hill-towns have been fertile in the richest treasures of intellect. The Litchfield County Jubilee showed a proud array of her sons among the most distinguished men of our country. On the other hand, those who despised labor in their youth, have not been the benefactors of the community nor of themselves. "The artificers and inventors of the world, the men who revolutionize human industry and manifold the wealth and power of nations by new machines and new processes of art—the Watts, the Arkwrights, the Brahmahs, the Clements, the Nasmyths, the Stephensons, the Fairbairns, the Fultons, the Ericssons, the Goodyears, the Howes, the McCormics, have usually had their training on the farm or in the shops."

A striking illustration of the value of work as an educator has been recently furnished by Rev. Washington Gladden of Springfield. He sent a circular to one hundred of the most prominent men of that place, asking, "Was your home during the first fifteen years of your life on the farm or in the city, and were you then accustomed to work when not in school." Of the eighty-eight who replied, five only "had nothing particular to do," while ninety-four per cent. were farmer's sons, or hard-working boys. So everywhere, as he clearly shows, the prizes of life are carried off by the men who learned to work. Men energized by such discipline are sure to outstrip those who were dandled in the lap of affluence and enervated by excessive indulgence. The farmer's boy learns patience and persistence by doing tough tasks without flinching. Mr. Gladden's conclusion from his inquiry was that the boy early trained to work, has eighteen chances of succeeding in life to one chance for the boy without this discipline.

Farm work, by the great variety of its forms and conditions, is peculiarly fitted to task and test the mind of a boy in planning, contriving, and adapting means to ends under constantly varying circumstances. The necessities of the farm teach the needful lesson that "where there is a will there is a way." Coleridge said "a perfectly educated character is little else than a perfectly disciplined will." The *will* is by no means the only faculty to be educated, but its right culture involves that of every other faculty of the mind and heart. It is the will that differentiates men. This is the regal power of the mind, and more than anything else in our intellectual nature constitutes the man. A disciplined will equips the mind for action. An earnest will is the agent of every great achievement. There is nothing like it to make the mind resolute and successful, loyal to duty, superior to doubt, disdainful of ease, delighting in achievement and rendering toil, self-denial, exertions in whatever form, easy and pleasant. A resolute mind will spare no effort, neglect no opportunity to accomplish its end.

Labor develops inventive talent. The exigences of the farmer, remote from villages and shops, compel him to be something of a carpenter, joiner, blacksmith, and harness-maker—a man of all work—"handy at anything." His business varies with the seasons, and sometimes changes everyday. A farmer's boy myself, early trained in practical industry and familiar with farm work, I have ever valued highly those practical lessons learned among the rough hills of grand old Litchfield county.

I counsel even the sons of affluence to spend at least one season at hard work on the farm or in the shop. The practical business drill there gained, the knowledge of nature and domestic animals, will amply compensate for the consequent loss in book-learning, to say nothing of the health and physical training thus secured. With all our improved gymnastics, none is better than manual labor, when it is cheerfully and intelligently performed, and especially farm work. The habits of industry, once formed on the farm, or in the shop, may shape all the future, teaching one to value time, to husband the odd moments, to scorn sloth and love labor, or at least to practice diligence in business.

The pupils who luxuriate in the wealthiest homes of the city would profit by one year in the country, with its peculiar work and play, its freer sports and wide range for rambles by the springs and brooks, the rivers and water-falls, the ponds and lakes, over the hills and plains, through the groves and forests; in observing nature, searching for wild flowers and curious stones, learning to recognize the different trees by any one of their distinctive marks, viz., the leaf, flower, fruit, form, bark, and grain, watching the ant-hills, collecting butterflies and various insects, noticing the birds so as to distinguish them by their beaks or claws, their size, form, plumage, flight, or song. Studying nature in any one or more of these varied forms, each so fitted to charm children, would refresh their minds as well as recreate their bodies.

The simple elements of the practical sciences should be taught in our schools, at least in oral lessons. A few talks on Agricultural Chemistry will invite its fuller study when the school days are ended, especially in observing the chemical marvels that will meet one on every rod of his farm. The lectures given in our Teachers' Institutes on the geological characteristics of Connecticut, show how profitably our teachers might each give simple lessons on the prominent physical features of his town, county, and State. Such talks will intensify the interest of the farmer's boys in the study of the stones and rocks which line their pathway. Specimens of our most common minerals ought to be in all our schools, procurable as they are by any competent teacher, without cost. No pupil should leave the public school without knowing the names and leading characteristics of at least a dozen of our common minerals.

Familiar lessons should also be given about plants and animals, the laws of health and animal physiology. A few hints on "how plants grow" will add interest to the flora found in such great variety on every farm. With specimens in hand, a few minutes devoted to pointing out the difference between inside growers and outside growers (saying nothing of endogens and exogens) or between parallel-veined and net-veined leaves, or the evergreens and those trees which drop their leaves annually, will awaken a lasting interest in the study of botany. How early children may learn the difference between the animal, vegetable, and mineral kingdoms, or that some animals have jointed backbones, that others have their bones outside of their bodies, while others have none at all. Such glimpses of the beauties and wonders of science awaken a healthful desire to observe and study. I remember well the interest awakened at a Teachers' Institute in Massachusetts, when Prof. Agassiz gave a lecture on the grasshopper. Having by the aid of the boys collected several hundred grasshoppers and etherized them so that they would not jump about, he passed one to each of his auditors. ' This created general laughter, and seemed ridiculous to many. But soon instead of laughing, or looking at him, every one was looking intently at the object in hand. When he pointed out minute parts some one said "can't see them," to which he replied "look again and learn to *look*, for I can see things ten times smaller than those to which I have called your attention. The power of the human eye is very great, and it is only the want of practice which sets such narrow limits to its powers. By learning how to examine *one* thing thoroughly, you learn how to see any thing. I present this subject to you teachers for the purpose of suggesting the desirableness and method of teaching Natural History in schools, and of using that instruction as a means of developing the juvenile faculties and leading them to the knowledge of the Creator."

If you ask, where can teachers be found competent to give such lessons, I invite you to visit our Normal School and observe how well its pupils are trained in the methods of teaching the elements of the practical sciences in our schools, and I ask the coöperation of the farmers in securing better qualified teachers for their children. By leading children to plant flowers, shrubs, and trees in the school-grounds, and by brief lessons on rural art, and especially on the beauty, variety, and value of trees, such an interest in their study and culture might be awakened as to make our youth practical arborists. Very little time would be required for those talks which would be sure to inspire an interest in arboriculture and in the broader subject of rural art and adornment. In this way, our public schools may prove a partial substitute for the schools of Forestry in Germany and other European countries, which have exerted there a remarkable influence in diffusing a general interest in arboriculture among the people. They regard forests as their friends, and understand their climatic influence and economic value in staying spring torrents, preventing summer droughts, as well as in supplying lumber and fuel. The Germans have a passion for nature, and love to frequent their beautiful groves and gardens, for parks and woods abound in and near their cities and towns. The rural and suburban adornment, now the pride and glory of so many beautiful towns in Germany, and the fruit of this revived love of arboriculture, is largely due to the influence and literature which have emanated from her schools of Forestry. Hence the wanton forest fires so common and destructive in America are comparatively unknown in Germany. The forest incendiary would be regarded as a common enemy, like the poisoner of an aqueduct, recklessly destroying that which it is the interest of all to preserve. Like their Forest schools, our public schools should create that healthful public sentiment which constitutes the best possible protection of the woods.

In connection with the Sheffield Scientific School, which by the act of the Legislature in 1863 became the College of Agriculture and the Mechanic Arts of Connecticut, the endowment of one or two additional professorships would inaugurate a department of Forestry. This could be done the more economically here, where the existing cabinets, laboratories, and philosophical apparatus might be utilized in forestral instruction. The endowment of such a department would prove a great benefaction to the State and to the country, opening new fields of investigation which would bear directly on the ultimate resources and permanent prosperity of the nation. The conclusions of foreign foresters, though confirmed by the broadest observations and experience in Europe, cannot all be wisely adopted in American sylviculture. Differences in soil, climate, and other conditions may affect trees in regard to their rapidity of growth, health, durability of timber, texture, elasticity and grain of the wood, and many other qualities. These vital questions can be determined only by careful investigations carried on in each country.

The Lombardy poplar, for example, was planted extensively in New England many years ago. Brought to England from the banks of the Po, in 1758, the facility of its propagation from cuttings, its rapid growth, its tall columnar outline in contrast with the spreading oaks and elms, soon made it a favorite in England, and hence with the fathers of New England. Sending out its almost upright branches all along its tall stem, it was much admired here, as it is still, by the Italians, and was of old by the Romans, who called it the *arbor populi*. But in New England, so many of its branches were winter-killed, that it soon became an unsightly collection of dead limbs, and it is now seldom seen. This is one of many illustrations of the necessity of adaptation to soil and climate, and of the fact, that some trees which thrive in one locality, will fail in another.

More than those of other workmen, the farmer's business binds him to his *home*. He lives on or near the soil he tills. Hence the farmer's home must often be somewhat isolated. To promote sociality and content, Col. Waring proposes that farmers should concentrate in villages, and for this purpose submit to the necessity of long daily journeys to their farms. This is unfortunately the European usage. There the cottages of the peasants are often crowded together more closely than are the homes in any well laid-out city, leaving scant room for outbuildings, to say nothing of gardens. This custom grew out of the necessities of a barbarous age as a protection from robbers, or out of that feudal system under with the serfs were crowded into huts under the castle-walls of their lord or chief.

The very isolation of the American farmer is one source of his conscious individuality, independence, and strength, when he is thus led to greater care and taste in adorning his home and grounds, and increasing the attractions of the fireside. It has long been my ambition to improve the homes and home-life of our farmers, and of all our industrial classes, and help them realize that the highest privilege and central duty of life is the creation of happy homes. The chief aim of the industries of life, whether agricultural, manufacturing, or commercial, and the great end for which government itself is worthy to be maintained, is that men may live in happy homes. "The hope of America is the homes of America," and the hope of Connecticut is the homes of Connecticut. You improve the schools by improving the homes, as truly as you improve the homes by improving the schools. Modern civilization relates especially to the homes and social life of the people, to their health, comfort, thrift, their intellectual and moral advancement. In earlier times and other lands, men were counted in the aggregate. They were valued as they helped to swell the revenues or retinues of kings and nobles. The government was the unit and each individual only added one to the roll of serfs or soldiers. With us the individual is the unit and "the government is of the people, and for the people, and by the people." America may be and ought to be the paradise of the laborer in the neatness, comforts, amenities, and attractions of his home. In no other way can the best interests of this nation be more surely promoted than by the elevation and ennobling of its home-life, and no agency can contribute to this grand advancement so universally and efficiently as our public schools.

Early in the progress of Prof. Northrop's address, the young ladies of the Normal School, to the number of about one hundred, entered the hall, and the Chairman said:

In behalf of the Board of Agriculture, I extend a cordial welcome to the Normal School. We are very grateful for the favor and compliment they pay us in visiting the Convention.

At the close of Prof. Northrop's lecture, the principal of the Normal School, Prof. Carleton, extended an invitation to the members of the Board, and others attending the Convention, to visit that institution, and it was voted to accept the invitation, and visit the school at quarter before two o'clock, this afternoon.

The Convention then adjourned to two o'clock.

AFTERNOON SESSION.

The meeting was called to order soon after two o'clock, and the Chairman introduced the speaker, as follows:

Gentlemen,—We have with us this afternoon a gentleman whom you all honor, and will love to hear. I have the pleasure of introducing Prof. Atwater.

HOW TO MAKE FARM LIFE AND PRACTICE MORE RATIONAL.

BY PROF. W. O. ATWATER, OF WESLEYAN UNIVERSITY.

The lecture is omitted at the request of Prof. Atwater.

The Chairman reported to the meeting an offer to the State of Connecticut from the Messrs. Storrs of New York, of a farm of one hundred and fifty acres in the town of Mansfield, and five thousand dollars in money, for establishing on the farm an agricultural school.

On motion of Secretary **Northrop**, the following resolution was passed:

Resolved, That the thanks of this Convention be tendered to the gentlemen who have made this munificent offer to the State of Connecticut, and that we cordially welcome it.

Mr. **Hinman** introduced the following motion, which, after discussion, was laid on the table for further consideration.

Resolved, That the Chairman of this Convention appoint a committee of three to examine this proposition, and report to the next General Assembly.

A discussion of questions from the question box here followed, and the meeting then adjourned to evening.

EVENING SESSION.

Vice-President Hyde called the meeting to order at seven o'clock, and introduced as the first speaker of the evening the Secretary of the Board, Mr. T. S. Gold.

THE FARMERS' CLUB.

BY T. S. GOLD.

Of all associations of farmers for their mutual benefit, the Farmers' Club is the simplest in its methods of working, and for its pecuniary cost and the time expended gives proportionately larger returns than any other form of organization.

The club is susceptible of variation in every direction to fit almost every condition of farm-life; territorially it may embrace a State, county, township, or may be confined to a neighborhood. It may be for a society, as the Farmers' Club of the American Institute in New York, or it may be of a legislature, or any other organized body.

It is the place to discuss all subjects pertaining to country life; raising and care of stock, fruits, crops of all kinds, the dairy, the kitchen, modes of living and habits of society, emigration, settling down for life, roads, and markets, all are in place here, as well as farm-buildings, fences, water-supply and drainage, farm improvements, preservation and application of manures, tools and machinery, culture of flowers, and rural adornment. The subjects are as diversified as the labors of the seasons, as the character of the soil, the occupations of the farmer, and his varied tastes and inclinations.

Some clubs have a formal organization, a treasury, library, and agricultural or natural history collections, and some hold exhibitions, thus adding to their primitive work, which is that of holding meetings for lectures and discussions, the business of an agricultural society.

The quality of adaptation is a peculiar excellence of the Farmers' club. It is adapted to the wants of farmers living in sparsely settled districts as well as to those who live in villages or more thickly settled farming neighborhoods. Every kind of talent may be utilized; the talking member who talks better than he works, and the working member who knows how to farm it, yet can hardly tell how he raises corn, each have their sphere, and make useful members of the club.

Farmers, as a class, neglect their social opportunities; they become averse to getting out, and hence are apt to lose those very qualities they should most cultivate—are apt to become impressed with the idea that they are not fit for society, until they get into the very condition they dread. Families get piques and antipathies toward each other that sometimes last for generations. Proximity of residence does not overcome this feeling, nay, often rather encourages it. A poor fence forms a dividing line more marked in its effect upon the adjoining proprietors than upon their cattle; so that often the farmer and his family are obliged to seek society at a distance, or to forego it altogether. Now here is just where the club comes in to break up these divisions. It is eminently democratic; all stand on the same social level. He must be a very poor specimen of humanity that cannot perform some one of the varied occupations of husbandry a little better than any other one in his circle, and he is king in that particular line. We once heard a man say of his father, who had just died, "Well, the old man would pile cord-wood so that it would measure more than any other man." I thought this was little to boast of, yet here was one thing in which he excelled others.

In the farmers' club all are teachers, all are learners. It is emimently a mutual benefit society. Every one may and should bring something to help others. It may be in bringing some material product for exhibition, it may be in words of wisdom or instruction, or it may be only in a word of kindly recognition and approbation, which shall not only make the recipient happier, but inspire to a more useful and noble life.

To be a successful farmer a man must be contented and happy; that is, he will be better in this condition than when he is striving for something beyond his reach. The farmers' club, by supplying his wants as a social being, by improving his power of conversation and address by practice, so that he is not altogether dissatisfied with himself, by giving him a knowledge of the wants and troubles of others, has a tendency to produce this quietness, to reconcile him to his lot, to cause his plans to look towards permanency, to have pride in his calling, and in making his mark in improving the old homestead, and transmitting it to his heirs more fertile and more beautiful from his labors.

In the club farmers learn not only from the successes and failures of their neighbors how to guide their affairs, but a wholesome spirit of rivalry is engendered, which shows itself in better buildings, crops, stock, and improved roadsides, the last place reached in the progress of rural improvement.

To illustrate the extreme elasticity of the farmers' club, its adaptability to different circumstances, we have only to refer to those actually in existence, in present working order, as examples. Take first the one with which I am most familiar and of which I may say scarcely a meeting has been held when I have not been present, at West Cornwall, formed in 1842. Organization very simple, officers chosen for the season at the first winter meeting, president, vice-president, and secretary; holds meetings once in two weeks during the winter, but gives way to other matters of interest so that some seasons there are but few meetings; meets at the houses of members; at each meeting, the time, place and subject for the next are arranged, or they are left to the call of the president or secretary; all are invited, young and old, male and female, the minister, the doctor, and the merchant, all are expected. The company being well assembled by about 7 o'clock, the men withdraw to their own room and discuss some agricultural topic till 9 P. M., then adjourn. Then another hour is spent with the ladies in discussing fruit or nuts (no extra entertainment is allowed), with neighborhood matters, and by ten o'clock the affair breaks up. When subjects of general interest are discussed the ladies are invited to join. Occasionally a public lecture or an entertainment is given under the auspices of the club. This simple machinery works well in a scattered rural community where the members attending different churches, having different post-offices, and centres of business, rarely meet except on some such occasion. The numbers present very often reach one hundred or more, but ten neighbors with their families will make a lively club when discussing some topic of local interest.

The club has existed long enough to show its fruits; in good neighborly feeling, respect for others, their wants and plans, it has proved a stimulus to the better culture of the farm, the garden, and the orchard; each has learned by the experience of his neighbor as well as his own, and as a class the club has made us better farmers, better citizens.

The New Haven County Farmers' Club meets twice a month, in the afternoon, in a room of the Sheffield Scientific School, for lectures and discussions. Here meet some of the most intelligent and enterprising farmers of the county, with some of the talent of the Scientific School and of the Experiment Station; forming a good combination of "theory and practice."

In Woodstock, Dr. G. A. Bowen gives the use of a suitable hall, where is kept the library, and a collection of seeds and agricultural curiosities. Perhaps there is no better organized or more efficient club than this in the State. Less than this could not be expected from the liberality and devotedness of the secretary, Dr. Bowen, united with the intelligence and enterprise of the farmers of Woodstock.

Some other clubs have hired halls or gratuitously furnished, others meet in school-houses or in town-halls, but most meet at the residences of the members, which latter course seems best adapted to every strictly rural community.

To kill a club, allow of sumptuous entertainments, and once around is about as far as you can go. The legitimate objects of the club are then lost sight of, it becomes a burden to families, and it had better take some other name.

Field-day meetings are held by some clubs in summer or autumn, to examine particular crops, modes of culture, farm buildings or improvements. We commend these field-day meetings to every neighborhood, even where they have no club, as instructive of themselves and also likely to result in the formation of a live club.

Some clubs hold an autumnal show, with or without premiums, and vie in the variety and extent of their exhibits with more pretentious societies.

Sometimes the club or a member of it purchases at wholesale, for the use of individuals, articles which they need in considerable quantity, as feed, seeds, or fruit trees, or looks up a market for their surplus products. Thus a considerable saving may be made on agricultural implements and machinery. Farmers have lost too much in trusting strangers and they should look more at home for example and advice. This is a legitimate field for coöperation.

How to keep the boys on the farm is a question often asked, and as shown by its repetition, but imperfectly answered. Farming has such variety in its occupations and duties, that it has always been the recipient of the broken portions of life from all other callings, and hence has had to bear the opprobrium that, if unfit for anything else, the boy or man should be a farmer. The reputation of the calling is injured by so many who have failed in other efforts, rushing to this for relief. This it always has bestowed and always will continue to bestow, but the reputation of the calling suffers.

If the boy has taste, capacity for a farmer, favor his inclination; his chances of success there will be greater than elsewhere; but improvidence, laziness, incompetence, are not qualities that promise success on a farm more than anywhere else. But what has the farmer's club to do with this? The influences which govern a boy in selecting his future business are those which cluster around his home; it is here he gets his first impressions; and as the farmers' club tends to elevate these homes, to make them more beautiful and attractive, to dignify the labor of the farm by making it more intelligent, we put our farmers' clubs as most potent in their influence upon the future lives of the sons of our farmers, and of their daughters too, for they will go together, and we must have either intelligent farmers and farmers' wives, or we must allow our children to seek other callings, to desert the old farms, to be occupied in turn by those who are willing to accept the drudgery; for education is too free and too easily obtained to be neglected by our children, and if they are shown at home that this has no place on the farm, that there is no sympathy with it there, of course they will desert the farm.

We have spoken of the great adaptability of the club to all conditions, of its elasticity; yet we must acknowledge that there are cases which even the club cannot galvanize into life; communities so steeped in dullness and apathy, selfishness, and conceit, bound up and hedged in by prejudice that nothing short of a special interposition of Providence can break the crust that covers them. A club cannot succeed any more than any other enterprise without proper material for its support. To conduct a farm successfully we must have the man competent and full of enthusiasm in his business; so, for a good farmer's club, we need live farmers, and the club will serve to keep up their spirits; will serve as a bond of union, of encouragement; will draw out their powers and make the community more harmonious and prosperous.

The few examples which we have given of clubs in practical operation are sufficient to indicate the wide field of effort open to them, and the results will be proportionate to the skill and energy exerted in its culture.

As they are adapted to the wants of every community, as the farmers' school, so their existence should be as universal as the common school.

The **Chairman.** I have the pleasure of introducing Prof. Cressy.

[The lecture of Prof. Cressy will appear further on.]

SECOND DAY.

The Convention met at 10½ o'clock, Mr. H. L. Stewart of Middle Haddam, in the chair.

OUR SCHOOLS OF AGRICULTURE.

BY PROF. W. J. BEAL, LANSING, MICHIGAN.

According to the old view of agriculture in our country, a farmer needs no education, or but very little. It was only thought necessary that he have a limited amount of practice on the farm, especially while young. Almost anybody could be a farmer. The clumsy implements used, the imperfect modes of cultivation; the superstition pertaining to many operations in planting and harvesting; feeding, rearing, and killing animals; the crude theories of animal and vegetable physiology; the composition and needs of the soil; the action of water, frost, heat, and light, all indicated that farmers, as a general rule, did not believe in acquiring much education.

In some parts of other states we still hear of men who cut timber in the moon, plant in the moon, cultivate in the moon, harvest in the moon, and kill hogs in the moon. They know that wheat will turn to chess, sorrel to white clover, horsehairs to worms; that timber grows spontaneously without any sprouts or seeds, and think the good old ways were the best. "They don't see no use nohow in book-larning for farmers."

Of course there are none of the old fossils here at this meeting, for they never go to such places. They know enough already. They have found out that "farming don't pay." We should, however, respect the memory of our ancestors, for most of them did the best they knew. They labored under great disadvantages in a new country, with little money, poor facilities, and that greatest of all obstacles, ignorance, with little or no inclination to improve.

Not every one who tilled the soil was satisfied with what he already knew. A few longed for something better, believed there were better modes of conducting farm operations, and set themselves to finding them out.

Scholarship has long been recognized as necessary for teachers, lawyers, doctors, and the clergy.

It is true that we now find many ignorant men who make money and a good living on a farm, but they owe much of this ability to educated men who have improved implements of all kinds, modes of cultivation and management of crops, and improved breeding of domestic animals. These men take what they have earned no right to — they look over the fence and receive information without money and without price. No class of men are under deeper obligations than these to men of culture and progress, and yet, they are often the very men who complain most of taxes to support the schools. I need not say that, in the true sense of the word, a man's success on the farm cannot be measured by the amount of money squeezed out of everything.

It probably may be difficult to prove, but I presume we could trace the early progress in agriculture to the efforts of some learned men of other occupations who took up farming for recreation, on as a business. Certain it is, that in modern times, some of our foremost successful farmers have abandoned other business for farming. Although the so-called fancy farmers often fail to make their payments, and are subject to the derision of "practical" farmers, yet they do much to advance agriculture. They make experiments for the benefit of those who will not make them for themselves.

Where agriculture thrives, there we always find a prosperous people. It has always been so, and doubtless it ever will be. Through thought and skill the last 100 years have witnessed great progress in agriculture. These are familiar to you and need not be enumerated at this time.

This awakening of thought in reference to our noble occupation leads to the establishment of schools of agriculture. The first were founded in Europe, and are not yet old, while the first in our own country are still young.

The State of New York established the first, but it was soon abandoned. Michigan followed next. The State Legislature voted in 1850, 30 years ago, to establish an Agricultural School, and five years later, made provision for its location and support. Two years later, in 1857, 23 years ago last May, the college was opened to students. It is the oldest college of its kind in this country. For some years at first, there was a strong effort to unite this college to the State University. An agricultural school was a new thing without any model. Almost every man entertained a different view of what it should undertake to accomplish. There were no trained professors of agriculture, agricultural chemistry or horticulture. There were no good text-books in these departments.

The customs of the farmers in Europe were so different from those of the farmers of the United States, that little could be learned in Europe which was just adapted to our practical people. For several of the above reasons, some of the earliest of the professors in agricultural schools failed to hold their positions. Changes of professors in some departments of our agricultural schools have been alarmingly frequent.

I give a list of Agricultural and Mechanical Colleges of the United States. Those which have no farm attached are marked with an asterisk. The list was taken from the Rural New Yorker.

NAME OF INSTITUTION.	Post Office Address of President.	State.
Agricultural and Mech. College of Alabama,	Auburn,	Ala.
Arkansas Industrial University, . .	Fayetteville,	Ark.
Agr., Mining, and Mech. Arts Col., Univ. of Cal.,	Berkeley,	Cal.
*Sheffield Scientific School, Yale College, .	New Haven,	Conn.
Agricultural Department of Delaware College,	Newark,	Del.
Florida State Agricultural College, . .	Tallahassee,	Fla.
*Georgia State College of Agr. and Mech. Arts,	Athens,	Ga.
North Georgia Agricultural College, .	Dahlonega,	Ga.
Illinois Industrial University, . .	Urbana,	Ill.
Purdue University Agricultural College, .	LaFayette,	Ind.
Iowa State Agricultural College, . .	Ames,	Iowa.
Kansas State Agricultural College, . .	Manhattan,	Kan.
Agricultural and Mechanical College, Ky. Univ.,	Lexington,	Ky.
Agricultural and Mechanical College of Louisiana,	New Orleans,	La.
Maine State College of Agr. and Mech. Arts,	Orono,	Me.
Maryland Agricultural College, . .	Agr. Col.,	Md.
*Massachusetts Institute of Technology, .	Boston,	Mass.
Massachusetts Agricultural College, .	Amherst,	Mass.
Bussey Institute of Harvard University, .	Jamaica Plain,	Mass.
Michigan State Agricultural College, .	Lansing,	Mich.
College of Agr. and Mech. Arts, Univ. of Minn.,	Minneapolis,	Minn.
Mississippi Agricultural and Mechanical College,	Starkville,	Miss.
College of Agr. and Mech. Arts, Univ. of Miss.,	Oxford,	Miss.
Agr. and Mech. Col., Univ. of Missouri, .	Columbia,	Mo.
Mo. School of Mines and Metallurgy, Univ. of Mo.,	Rolla,	Mo.
Agricultural College, University of Nebraska,	Lincoln,	Neb.
College of Agriculture, University of Nevada,	Elko,	Nev.
N.H. Col. of Agr. and Mech. Arts, Dartmouth Col.,	Hanover,	N. H.
Scientific School of Rutgers College, .	N. Brunswick,	N. J.
Col. of Agr., Mech. Arts, etc., Cornell Univ.,	Ithaca,	N. Y.
Agr. and Mech. Col., Univ. of North Carolina,	Chapel Hill,	N. C.

	Post Office Address of President.	State.
Ohio Agricultural and Mechanical College,	Columbus,	Ohio.
State Agricultural College, Corvallis, Oregon,	Corvallis,	Oreg.
Pennsylvania State College of Agriculture,	State College,	Pa.
*Agr. and Scientific Department Brown Univ.,	Providence,	R. I.
S. C. Agr. Col. and Mech. Institute, Claflin Univ.,	Orangeburgh,	S. C.
Tenn. Agricultural College, Univ. of E. Tenn.,	Knoxville,	Tenn.
Agricultural and Mechanical College of Texas,	College Station,	Texas.
*Univ. of Vermont and State Agricultural College,	Burlington,	Vt.
Virginia Agricultural and Mechanical College,	Blacksburgh,	Va.
Hampton Normal and Agricultural Institute,	Hampton,	Va.
Agricultural Department, Univ. of W. Va.,	Morgantown,	W. Va.
College of Arts, etc., University of Wisconsin,	Madison,	Wis.

These are located in thirty-seven different States. Each college differs in some respects from every other. Some of them possess and till large fertile farms, performing much of the work with the aid of students; some till only a small farm with students; some possess no farms; some till the farm entirely by hired labor, without the aid of students, and try to make money in the operation. "To run a farm for profit" is one great point made by some of the colleges. There are some colleges connected as branches to a university, others are distinct; some have only an agricultural department; some have military training; some a mechanical department.

There are various plans for students to work. In some colleges students all work at one time of day; in others, at different hours. In some colleges students all work every day throughout the course; in others, during only a part of the course. Some require very little work of students; others as much as three hours daily. In some of the colleges, students are taught telegraphing, engraving, printing, designing; and the girls are taught the art of cooking, sewing, and household economy.

In some places students are paid for all their work; in others, a part or all of the work is for practice and instruction, without remuneration.

We have agricultural colleges with the terms extending through the coolest part of the year, and in the others the term extends through the warmest part of the year, with a long winter vacation, in which students can engage in teaching school.

We have colleges in warm states and in cold states; in states where agriculture is the prevailing industry, and in states where manufacturing is the chief occupation.

I think our country is particularly fortunate in having such a variety of industrial colleges located in the several states. Most of them are proceeding without a model; all are striving to pursue the best way, so far as their means will permit. In time, errors will be eliminated, and the best courses will be learned. In a few years we shall somewhere have a model agricultural college, and probably more than one; while others will dwindle, go down, or continue to pursue a course not very different from other colleges with literary and scientific courses.

In Mississippi, Texas, and perhaps in other states, they have abandoned the practice of uniting an agricultural college with a university. In attempting to successfully unite the two they failed, and have started anew in separate colleges. This was the experience of our friends in Canada. In their noble university, which was well-equipped, they attempted to attach an agricultural college. The officers in charge, after the trial, reported that "The one word, *failure*, gives the history of all such arrangements. Agriculture is overshadowed by other studies; farming is elbowed out by other professions. Agricultural students feel themselves of an inferior grade, the class a dwindling and unsuccessful affair. Stubborn facts refuse to sustain the theory that this department will work well in connection with a general literary course."

For several years they have had an agricultural college, separate from the university. During the past year, report says that they were compelled to turn away two hundred students for want of room. Students all labor, often as much as five hours daily.

What shall constitute success in an agricultural college, is a question quite difficult to decide. Each may be successful in some respects and not in others. We shall differ in opinion as to what an agricultural college ought to attempt. We judge that a college is more or less successful according to the extent and quality of the training given to its students. A successful college is expected to be popular with the class of people who support it; to draw large numbers of students, and to retain a large proportion of these till they complete the course.

Further than this, most people consider what becomes of the students after pursuing a partial or a full course in an agricultural college. No matter what course of study they pursue, their life work will often be modified by the condition of the country in which they live. If agriculture is depressed from any cause, and the outlook for farmers is discouraging, young men will often seek other business, no matter what has been their training. If agriculture is "booming," many bright young men will seek the farm as a life work. After all, the early training of a young person will have very much to do with his choice of business. In Michigan there are some excellent reasons why all of our young men, after a course in the agricultural college, do not engage in farming. Some students attend the college because they think the opportunities are excellent for obtaining a good education. Some of them have no idea of ever becoming farmers. From the start, they expect to become lawyers or doctors, or engage in some other business. Some attend the college for its excellent advantages in chemistry, or entomology, or botany. Students are induced to attend for various reasons of more or less importance. They flock to college after each other, as sheep over a fence.

After studying for a while, a young person may find that his taste leads him to follow some other pursuit than farming. We have no right to reject a person in Michigan agricultural college for not taking an obligation promising that he will become a farmer. He is allowed to remain and pursue his course if he keeps up with his class and behaves himself.

I have two students in mind who will not likely ever become farmers. One of them went to Philadelphia and attended the Centennial Exposition. He was there a week. On the first day in the morning he went straight to the art gallery and remained there all day. The remaining days found him in the art gallery. His skill with the pencil and his taste are all in one direction. He will be an artist or an architect, and probably a good one, and that is the place for him. Our course in agriculture and horticulture, botany and chemistry, has been a benefit to him.

Another student is an expert at drawing faces in caricature. He cannot keep his mind from these things. He likes drawing and succeeds in it, and all the attractions of the plow and the hoe cannot tempt him to give up the pencil and the brush.

One graduate told me that he was brought up on a farm at home, but he never liked it. After graduating he thought more of farming than he ever did before, but he was going to select law. Others entered with the intention of becoming teachers, lawyers, or engaging in something besides farming, but the course at the college changed their minds in favor of farming. No matter for what reasons students enter Michigan Agricultural

College, most of them, after leaving, intend sooner or later to go on the farm.

Many of our students are poor, and have no means with which to buy farms after completing a course of study.

They will become clerks, book-agents—anything that is honorable—by which they can earn the most money for the time ; but, when money is earned, they intend to buy a piece of land and make a farm of it. Going to an agricultural college will not necessarily make a young man choose farming as a business, nor will steady work on a good farm. If we wish a son to become a farmer, and he has no particular bent in another direction, we should keep the farm in his sight all the time. We must contrive by all honorable means to show him that it is not all drudgery, and that there is no business or profession in which a strong, well-trained mind can be used to better advantage. I cannot see why every farmer should wish his son to become a farmer, but it is generally the rule.

In Michigan, the students have from the start labored three hours a day. They have kept up a familiarity with various operations on the farm, orchard, and garden. In, perhaps, a dozen cases students have boarded away from the college, and have not been required to work. These have all, so far, chosen other occupations than farming. Perhaps they might have done the same had they been required to work three hours a day. Exemption from work —out-door farm work—has always tended to wean students from the farm, so far as my observation has gone.

A four-years' course in college is not too much time for a young man to spend in acquiring a general education, and in learning something about agriculture. A farmer needs a symmetrical education as well as anybody. He should know how to read and speak the English language correctly. He needs to know something of history, political economy, mathematics, book-keeping, botany, zoölogy, chemistry, mechanics, meteorology, physiology, drawing, logic, landscape gardening, civil engineering, a little of architecture, and of course he should know something of veterinary science, agriculture, and horticulture.

Unless the student acquire a general education in school or college, he is not likely to learn these branches ; and is, therefore, liable to become unsymmetrical and narrow.

In a college course for farmers, I place great stress on the thorough training to investigate any topic. They should make some experiments, and study the laws of correct experimentation. They will thus acquire the habit of obtaining information for themselves.

I have named the branches which seem of most value for students to pursue in an agricultural college. Very much depends on the manner in which these branches are taught. The right men ought to be employed, whose specialties are just what is of most importance for the students to learn. In agriculture and kindred topics, the teacher should possess a practical turn of mind, and good business habits. There are many things which cannot be well taught in the class-room. I have just completed a course of daily lectures on horticulture to a class of juniors. Every attempt possible has been made to impress certain facts and methods clearly on the minds of the class. Most of them have been brought up on farms. After my efforts, I should be ashamed to read you some of the mistakes made in their examination papers. Some of these were made on account of erroneous notes taken during the lectures, some through a misunderstanding of some of my statements. I have found that there is not much use in attempting to teach some things in the class-room and I have given up that way.

A few years ago, after spending the best part of two lectures on the structure of the grape-vine and a few modes of trimming, I questioned my students on the subject. They seemed to understand it all perfectly. The next day, eight or ten of them, each with knife in hand, was asked to prune a grape-vine. They all hesitated and wanted to see me trim one first. I did so, and then directed each of them, all being allowed to suggest mistakes made by the others. Each trimmed three or four vines. Some of them said, "This is worth more than all of your lectures on the subject. Now we understand it."

I might relate a similar experience in reference to some of my early teaching of animal physiology, botany, and zoölogy.

At present, and for the past two or three years, our course in horticulture has been divided into two parts, one consisting of a course of lectures given in the class-room, and the other a course of training in garden or orchard. Students are all taken, about eight in a company, with the proper tools in hand, at the proper season of the year, and have actual practice in budding, grafting, layering, making cuttings, trimming drives, cutting and laying sods, trimming apple-trees, thinning apples, trimming grape-vines, raspberry-bushes, picking, assorting and packing apples, marking out orchards, taking up and setting out large and small trees and plants, care of hot-beds, management of celery, use of garden implements, crossing flowers, fighting several kinds of insects, and many other operations.

This lesson comes, through one year, as often as twice a month for each junior, and continues for one or more hours, sometimes for three hours. Each is asked to make any suggestions or improved methods, or criticise any point in the work. This is made a part of the course, and is required of each student as much as his lessons in geometry. No pay is given for such work. Sometimes a student works three hours a day for two days or more, as in trimming apple-trees. The trees are all labeled and numbered. Each student takes his trees, and, when done, the members of the division inspect the work, with the professor, for criticism.

This is valuable work and we cannot have too much of it. We are likely to get too little of it, because it takes time and foremen, both of which are deficient. Unless the account goes upon the college record and finds a regular place, it is likely to be neglected or crowded out.

A whole course of such training, and such *only*, would not be enough for an Agricultural College. It would be all art and no science; all practice with no reasons. The students need regular lectures and recitations and practice in writing essays. They must have *laboratory* practice in chemistry, zoölogy, and botany. For example, the old way of teaching and learning botany would not answer. Historical and systematic botany are all well enough, but they should not take the place of drawings and notes, carefully made after prolonged study, with microscopes and other apparatus.

Book learning and the study of drawings to illustrate the text in works on botany, zoölogy, and mechanics can no longer be palmed off as valuable training.

The Old Botany, or the old way of teaching it in many places, was somewhat as follows: The teacher is supposed to be a dried-up old fellow—a regular fossil. He wears odd-looking clothes. He usually teaches his classes from the text-book, and prefers to pursue the study in winter, so pupils can learn the names and peculiarities of plants before the plants themselves appear in spring. There are many hard, unfamiliar names in this study.

With no specimens to illustrate the lessons and a dry teacher, most of the pupils have acquired a thorough disgust of the study long before warm weather furnishes specimens for illustration. In time spring flowers appear, and the pupils are supplied with them. Each may have a cheap microscope, which he is compelled to hold in one hand. The teacher and class hastily and superficially run over the various parts of the plant. They all turn to an artificial key and wade through this part of the book till the teacher says, "We have found the order to which the plant in hand belongs." They turn to the page for the order and proceed till they come to the name, which may be *Claytonia Virginica*, *Hepatica triloba*, or *Ranunculus fascicularis*. And what next? "We have found the name of the plant." The pupils have merely had an introduction to the stranger in the most formal manner. The teacher can suggest nothing further for the pupil, except that it would be a good plan for each member of the class to collect specimens, press, dry them, place in a portfolio, and give each a label, on which should be written the Latin and common names, the habitat and time of flowering. The pupil has been taught that it is all of botany to learn the names of the parts of a plant, or the parts which are not too small to be easily seen with a cheap hand-glass. Mysteries are still unsolved, and the plant is still a stranger. We ask it no questions: we receive no replies. We have only glanced at the exterior. Such is the mode of study which I say "can no longer be palmed off as valuable training."

THE NEW BOTANY.

A much better way of beginning botany than the above, at least one which I have found better for my classes, may be indicated somewhat as follows: Before the first lesson each pupil is given some specimen to study. If flowers or growing specimens cannot be had, give each a branch of a tree or shrub, which branch may be two feet long. The examination of these is made during the usual time for preparing lessons, and not in the class-room. Without having the specimens in sight, they are to tell what they can about them for the next recitation. They can use books if they prefer, though it is better that they do not. No books can be found that will give much assistance on such a lesson. The time arrives, and the hour is mostly spent in hearing different members report their discoveries, until all have had a chance to add anything not noticed by any other member. The teacher suggests a few other points for study. The pupils are not told about things which they can see for themselves. An effort is made to keep them working after something which they have not discovered. If two members disagree on a point, on the next day, after further study, they are requested to bring in all the proofs they can to sustain their separate conclusions.

It is often astonishing to notice how much is discovered by so many good eyes. For the next lesson the students review the first lesson, report on a branch of another kind of plant which they have studied, and notice the points of difference and similarity between the two. In like manner new branches are studied and new comparisons made.

For some weeks but little use is made of microscopes or text-books. In nearly all important cases specimens are examined, and a need felt for a name or a definition, before these are given. After a few lessons answers to the following points are brought out:

Is there any definite proportion of active to dormant buds in any year? Where do branches appear? Is there any agreement in growth as to length of branch and size of the annular ring each year? Is there any similarity of rapid or slow growth of all the limbs on a branch in each year? Is there any certain number of leaves on a year's growth, or any definite proportion between the lengths of internodes? Can the smallest, old, dormant buds be made to grow? Is there any order as to what buds grow and what remain dormant? How much and on what years did each limb grow? There are three ways of telling the age of a branch—by the bud-rings, stem-rings, and color of the bark. The shape, other peculiarities, and variations of buds, and leaf-scars in any species are noted; also the arrangement and position of the buds and bud-scales. Is there any order in the arrangement of the specks on a branch? Do the specks change as the branch grows older, and if so, how? How many leaves each year were required to build up the branch? How large were the leaves and the amount of surface exposed? Did the amount of growth in any year correspond to the number of leaves on the twigs and main axis? Does the ring of wood depend on the growth of the main axis? The arrangement of the scales of cones are studied in this connection. In each case the students are requested to try to classify the topics or place them under proper headings. They are now ready for a book lesson on branches, buds, and phyllotaxis, and they will read it with interest and profit.

In like manner any other topic can be taken up, provided plenty of specimens can be supplied, as roots, seeds, fruits, stamens, petals, sepals, leaves, etc. After each of these comes the study of the book. Beginners should study plants and refer to books, and not study books and refer to plants.

Some of the above topics are admirably well adapted for theses or compositions. I usually give each student one or more of them each term. For the younger students this year, the following topics will serve as examples: "Compare the leaves and young branches of the Scotch pine with those of the Austrian pine," or "black spruce and Norway spruce," or "sugar maple and red maple," or "butternut and black walnut."

As students advance in systematic botany and morphology, other subjects for theses are assigned, of which the following may serve as examples:

The arrangement and development of parts of the flower, with reference to its self-fertilization, or fertilization by insects, birds, winds, or by other means. Below are samples: Moth-mullein, dog-bane, common sage, thyme, red clover, plantain, milkweed, mallow, thistle, cleistogamous flowers of violet, campanula, iris, lobelia, martynia, Indian corn, wild balsam. One student may study the vines of dodder; one, the climbing of Virginia creeper; one, the twining of the wild morning-glory; one, cucumber tendrils; one, unequal-lobed leaves; one, the time of opening and closing of flowers; several, the development of some irregular flowers; one, the order of dehiscence among anthers of a flower; one, the honey-glands of some flower; glands in other parts of plants than flowers; growing beans in all sorts of soil and with more or less light; the germinating power of weevil-eaten peas; the relative order of development of stamens and pistils of many plants of Indian corn; for what do ants visit plants?

The theses were made up of original investigations and experiments, and were read in class. Students use stage microscopes. Later in the course, each is supplied with a good compound microscope, in a suitable room, where he works daily for a term. Pupils prepare their own slides, make notes and drawings, which are preserved at the college. Most of the time for the term is spent on one plant, a favorite of which is the common pumpkin.

I have been quite particular to show the course pursued, because some think it is difficult. Aside from collecting specimens, it is an easy way for the teacher. But little time is occupied in lectures. Short talks of fifteen or twenty minutes are often given. Zoology and physiology can be equally well taught in the same manner. Students are shown how to become independent and reliable observers and experimenters. Training is better than teaching. On this point I quote briefly from a recent number of the *New York Tribune.* "Teaching communicates ideas, training forms habits. Teaching imparts knowledge, training develops power. In teaching, the adult explains words. In training, he shows methods. Under teaching, the child hears what is said: under training he sees what is done," and I may add he learns to do it himself. "Training is food which gives strength to run." To train is to show how. Training develops power, which is more valuable than knowledge.

The management of students' labor is somewhat perplexing. For perfect success it needs foremen with unbounded tact and an unlimited amount of patience. For work, students receive pay at a maximum rate of eight cents per hour. During one season, from spring till autumn, one class works on the farm: during the next season the same class works in the horticultural department. To a considerable extent the Seniors are employed as assistant foremen, with small gangs of hands, at various kinds of work. Some of them succeed well; many of them can never learn to manage others to good advantage. About half the Seniors work all the year in the horticultural department. One Senior is set over some portion of the department for the whole year. One looks especially after the vineyard, one the apple-orchard, one the orchard for pears, cherries, and plums, another the trees on the lawn, another the drives and paths, one the hot-beds and a portion of the vegetable garden, one the wild garden and testing seeds, one the plats of sample-beds of grasses, clovers, etc.; another certain experiments, another collecting and pressing plants for class-use and the herbarium.

Whenever any work is done in each of these places, the proper Senior is there to act as foreman in directing the labor of other students. Young men take great interest in the work over which they preside, often working extra hours, if necessary.

They are allowed, as far as practicable, to choose the work they are to look after during this last year of the course. These young men assist in making experiments. They very often make some on their own account. For example, during one year, one crossed wheat for new varieties; one crossed wild and cultivated crab-apples; two crossed corn; two or three crossed lilacs; one observed the duration of flowers of several kinds; one crossed tomatoes; one observed the peculiarities in the germination of seeds; one studied monstrosities among flowers; another layered apples; one studied the nodding of the heads of wheat; another the depth of the roots of barley and oats; another tested "buggy" peas and those not buggy, for comparison. I could name pages of other small experiments undertaken by students.

Students work as well as they study, and feel much worse for receiving a low rate of wages than they do for receiving low marks for recitations or examinations.

Students talk about agriculture, and write about it in some form or other, in their orations and essays.

After graduating, what becomes of the students? Literary colleges send only from one to three per cent. of their graduates to the farm.

Not all who take a course in medicine become practicing physicians. More than half of those who take a law course do not engage in law. I have never heard any one find fault with these schools, because all of the graduates did not pursue a course in accordance with their especial training.

Michigan Agricultural College has graduated 212 students, employed as follows:

Farmers,	86	
Fruit culturists,	8	
Professors of Agriculture or related sciences,	13	
Instructors or foremen,	3	
Students in agriculture,	2	
Agricultural editors,	2	
Apiarists,	5	
Engineers,	4	
Architect,	1	
Landscape gardener,	1	
Veterinary surgeon,	1	
U. S. Signal Service, Sergeant,	1	
Machinist,	1	
Total Industrial Arts,		128

Business men,	26	
Teachers,	22	
Lawyers and law students,	18	
Physicians and students of medicine,	9	
Ministers and students of theology,	3	
Editor of News Paper,	1	
Deceased,	5	
Total number of graduates,		212

If we exclude those deceased, and one lady graduate, over three-fifths may be counted as now engaged in pursuits which are in keeping with the objects and training of the Agricultural College.

Some thirteen hundred other students have spent from one to three years at the college. So far as known, a large majority of these are farmers.

Of the graduates, one is professor of botany and horticulture in Cornell University; one professor of zoology and entomology in Michigan Agricultural College; one professor of agricultural chemistry in the University of Wisconsin; one professor of economic botany in the University of Missouri; one professor of botany in the Iowa Agricultural College; one professor of chemistry in Oberlin College; one professor of chemistry in the Agricultural College of Mississippi; one professor of agriculture in Kansas Agricultural College; one professor of mathematics in Michigan Agricultural College; one professor of agriculture in Purdue University; one professor of chemistry and horticulture in Colorado Agricultural College; one professor of agriculture in Texas Agricultural College; one professor of agriculture in Mississippi Agricultural College; three are foremen in Michigan Agricultural College.

One is associate editor of the American Agriculturist; one secretary of the Michigan State Horticultural Society; one has charge of the experimental and test gardens of a very large firm of seedsmen; one is a Trustee of Illinois Industrial University; one a member of Michigan State Board of Agriculture.

My remarks might be much extended in speaking of the high positions and success of other graduates, and of those who took a partial course. Although the list of graduates is not a long one, yet it is one of which the managers of Michigan Agricultural College are justly proud.

"Does the farm pay?" This is a question often asked by the farmers of Michigan. Does it pay what? Does it return more money into the State Treasury than it draws out? Does it pay as a part of the apparatus with which to educate students? As a general thing, the farm returns more money than it costs to manage it, though sometimes the reverse is true. If the farm were managed purely for making money it would be worth much less for training the students than as now managed. It is proper to ask that no waste be allowed in conducting the farm.

For some time past people have mostly ceased to ask this question of our horticultural department, "Does it pay?" There is much time and labor spent in labelling trees and plants, in keeping the grounds in order, in planting and caring for ornamental trees, in enlarging and caring for the botanic garden and experimental plats. The orchards, vineyards, and gardens are planted with varieties by the score, where but one would be planted for profit, if only a large money return were anticipated. The grounds, orchards, and gardens pay as a great laboratory for our students, and the large number of visitors who come to gain information.

Should experiments be made at Agricultural Colleges? Some may think this a queer question and take it for granted that Agricultural Colleges were established to a great extent for this very purpose. So far as I can learn the teaching force in nearly all such colleges is less than it ought to be. If experiments are made with the present plans, the teachers are compelled to perform double duty. Good experiments cost money, and they cost something else which is equally valuable, viz.: careful plans and skilled labor.

Most people greatly underestimate the difficulties of conducting experiments which shall be valuable after they are performed. For several reasons I should say, By all means conduct experiments at Agricultural Colleges. There should be a separate fund which should be perpetual, and to a great extent separate persons should be employed to make experiments. The public and trustees of colleges are not likely to think it necessary to diminish the time which a professor devotes to teaching, because he devotes considerable time to making experiments.

Good papers and books, agricultural and literary, will always be sought and read by farmers who keep abreast of the times. The less education the members of a family possess, the poorer and cheaper will be the papers and books which they read. The man who thinks the most and the deepest enjoys the most. It is somewhat disheartening to see what trashy papers called "agricultural" will be pronounced "good" by a certain class of farmers. Some of them are poor hash and make feeble diet.

On the whole our agricultural papers are steadily growing better, and will continue to grow better, and the best will be better patronized, as our farmers become more generally well educated. Our Agricultural Colleges, I am certain, are doing more than any other one thing to improve the quality of our agricultural books and papers. Farmer's Clubs accomplish something in the same direction. They are worth all they cost, and should be encouraged; but they are very few in number, and most of them feebly sustained.

Granges, at least as we have them in Michigan, are better than clubs, because there are many more of them, more people attend them, the meetings are held oftener, they include all the adult members of the family, and closely connect the farmers all over our country.

Well-conducted farmer's institutes accomplish a good work, not so much because the mass of men who attend them learn a great deal during a few short sessions, but because they arouse zeal and enthusiasm, and cause a farmer to think more of his calling.

For the past five or six winters, the Michigan Agricultural College has held six institutes every winter, in various parts of the State. The State Horticultural Society holds three meetings and one fair. Perhaps ten or fifteen other general gatherings of farmers are held each year, for similar purposes. At these meetings will be present from 200 to 1,000 farmers, including members of their families.

At these gatherings we learn from each other. The college men glean items of great value from the experience of men who work their farms; the farmer receives new hints from the college men to be put in practice. Each helps the other.

Books, papers, clubs, granges, fairs, institutes are all valuable, but they are a poor substitute for a systematic training, under good teachers, in several of the sciences.

The habit of close observation is of inestimable value to every farmer; without it he loses many golden opportunities. With close observation generally comes accuracy and correct judgment. A thorough scientific education is also valuable, because it gives the one who acquires it the habit and power of readily acquiring information whenever he may desire. The self-made man, if he acquire this habit, has to travel the same road as the college man, though he labors under a great disadvantage in not having teachers to guide him in the easiest way.

In our country, there are many thoroughly educated farmers who are an honor to their noble occupation. We need one hundred where we now find but one.

On the farm there is need of more brain-work and less with the hands. At all times brain-work pays the best returns for the time given to it. Labor with the hands is easier than work with the head. If a greater proportion of farmers were well-educated, people would consider farming a higher business. Any occupation takes rank according to the culture of those who are engaged in it. Farmers need to mingle more with each other, and with the best of those who are engaged in other occupations.

Mr. ———. Much valuable information was obtained from Dr. Cressy last evening, after the lecture, of practical benefit to the people who own horses; and so I would like to have Prof. Beal reply to questions in like manner. I would like to have him give us a practical illustration of how he teaches his class to trim fruit-trees and grape-vines, at what time of year, and what method he pursues.

Prof. Beal. The matter of trimming trees is discussed in our lectures; the reasons are given for trimming them at certain times of year, and the reasons for removing certain limbs, etc. We live in a part of Michigan where the climate is exceedingly severe, the thermometer going down to thirty-three degrees below zero—something you never dream of here, I suppose; and as our seasons are rather short, our trees have to be managed according to our climate. In some places in our State, apple-trees are trimmed in the form of an inverted umbrella, with an open center. In Central Michigan, where I live, that is a bad practice. It lets in the summer sun, and the cold of winter seems to affect trees trimmed in that way worse than those trimmed under a different system. I have seen a good many trees killed by this treatment. Our plan is to leave the center at the top about as thick as the sides, and trim the tree all round. I do not think I ought to occupy the time by giving a lecture on just how we prune trees. The students take their tools in hand, and I remind them again of a few of those rules; to take off no limb from an apple-tree which is much over an inch in diameter, because the tree is likely to be damaged by removing a large limb, and it is likely to leave a large scar. Even if we paint it over, it weakens the tree. It is better to trim a little every year than to take off a good deal once in five or six years. Then they are advised again, instead of taking off limbs right around the center of the tree, out of the head of the tree, and thinning them all out and leaving the branches at that place naked, to cut off small limbs among the outer branches all over the tree. Sometimes the operator thins by cutting in from the ends and cutting off the small limbs. Theoretically, it would be well to cut off only the smallest limbs, but apples are so cheap with us that it would not pay to pursue this method, and so they generally cut off limbs the size of my finger. It takes a good while, by this process, to make a little display, but it seems better for the trees. The implement we find about as handy as anything is a two-inch chisel ground with a notch in the end like the letter V, with a handle five or six feet long, and the student has a little mallet in the other hand, with which he strikes the handle and thus cuts off the limb. But where the limbs are forked, he is unable to cut them with this implement. This trimming is usually done quite early in the spring, in March, and sometimes in February.

Mr. Wadsworth. Can you change the bearing year?

Prof. Beal. We have sometimes changed the bearing year by picking the fruit. This year it appeared that everybody in Michigan, as far as we could hear, was to have an abundance of fruit; and after the apples were fairly set, it occurred to me that our apples would be very plenty, and I put the students in the trees to thin them when they were about the size of my finger-ends. It would take a student perhaps three hours to thin a tree eighteen years old, and as they were paid eight cents an hour, it would cost twenty-four cents. That is not very much. We thinned the apples so that some people thought we would have no crop. There were a few left, and they grew large and fine, and were of excellent quality, and we have strong trees. I am satisfied that they will stand a much better chance of having something of a crop next year. We pay a great deal of attention to thinning all kinds of fruit. Grapes and plums are more than half picked off, and no one in the West now thinks of raising nice peaches without thinning. I suppose that is the same here.

Question. I would like to inquire if the fruit-buds have formed for another year on those trees that were thinned?

Prof. Beal. I have not examined them this year to know just how they are, but there are some fruit-buds on them at any rate. Trees may have fruit-buds, and yet not bear fruit. I have studied this matter somewhat, and I find that when trees blossom fully and produce no fruit, there is likely to be some reason for it. There may be a bad storm just at the time the flowers appear; and another reason is, that the trees produce feeble flowers. The anthers are shriveled and produce poor pollen, and many of the pistils, in certain seasons, are small, short, mere rudimentary pistils, which cannot be fertilized to produce fruit, whereas pistils of the usual length may be fertilized and produce fruit. These are some of the reasons that will account for the failure of the crop when apple-trees may blossom fully.

Mr. ———. I would like to ask the speaker a few questions in regard to the honey-locust. Two years ago this spring I purchased four thousand hedge plants through a firm in western New York, and now, to my disappointment, about one-half of the plants in the line are perfectly smooth; as smooth as the osier willow; the other half are thorny. I wrote to the party I purchased of, telling him my complaint. He replied, saying that he never yet saw a lot of honey-locust hedge plants in which some of the plants were not perfectly smooth and without thorns, referring me to an old apple-tree in the pasture where cattle had browsed upon it, and in a few years it would become thorny. I would like to ask you if I can have any hopes of those plants that are now perfectly smooth ever becoming thorny?

Prof. Beal. I think your hedge will not all be thorny until the plants get old. There is a variety of honey-locust, so called, which produces thorns only to a very limited extent.

Some of your trees as they grow older may throw out thorns, but I doubt if they all will. They do vary in that respect, as the nurseryman told you. It is possible some of his seed came from the smooth variety.

Mr. ———. He referred me to two trees now standing in his grounds, one of which is perfectly thorny and the other smooth, and he termed them male and female.

Pref. **Beal.** He is all off the track there.

Mr. ———. I supposed the stamen and pistil were on the same tree of the honey-locust.

Prof. **Beal.** Yes, sir. There is no distinction in that way.

Mr. **Gold.** Are not the male flowers of the honey-locust on one tree and the female flowers on another, usually?

Prof. **Beal.** I think not. I think the same tree has the staminate and the pistillate flowers to some extent. I know we have one tree in our place that bears flowers with pistils and stamens also. No doubt some trees have that peculiarity. Some of our red maples have stamens and pistils and some only have pistils.

Mr. **Gold.** One of my first observations in botany was, that there were two trees of that variety in the town where I resided, and only two. My father's tree bore pods; my neighbor's tree, in another part of the village, never bore any pods at all.

Question. Did the tree that did not bear pods have any thorns?

Mr. **Gold.*** I think they were both thorny.

Prof. **Beal.** I presume so.

Question. Can you give us any reason for the fruit dropping prematurely in our country?

Prof. **Beal.** I can only answer the gentleman in a general way, not being familiar with the conditions of fruit-raising here in Connecticut. In our State, fruit drops for a variety of reasons. It may prematurely ripen from some injury caused by a hail-storm or by insects. The codling moth causes it to drop. Then there are certain varieties that have stems so formed that the wind takes hold of them and causes them to drop badly. Those sorts that usually drop badly are rejected by planters; they plant other sorts that hold on better.

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* The honey-locust is polygamous; producing staminate or pistillate flowers, or both, on the same tree.

QUESTION. I would like to inquire if the bearing year can be changed permanently? If you have succeeded for one or two years with a tree, can that change be made permanent?

Prof. BEAL. Not certainly, in all cases. I have tried that in some cases. I have taken all the fruit off of a northern spy in the bearing year, and the next year it bore considerable fruit. But it inclines to go back to the old way. I have no doubt that in a few years it will get back to the old habit, unless the practice of thinning is followed up. I have known a case where a man had two trees of the Talman's sweet, for instance, in his garden. He took all the fruit off of one of the trees one bearing year, and followed that up for a few years, and now they are bearing in alternate years, just as he wanted them to. By thinning heavily in productive years, we can do a good deal toward getting fruit in other years.

Mr. ———. I have seen an orchard that bore in the odd years, and I asked the proprietor how he got fruit at that time. He said he started his trees right. There has been an abundance of fruit all over the State this year. I saw that orchard a year ago, and it was full; this year the crop was very light. The remark he made was, "I start them right." That is, he commenced by picking all the apples off of the trees in the bearing year, and they produced in the off year, and continued to do so.

Prof. BEAL. The experiment is worth trying, and it does succeed to a considerable extent, but is not absolutely certain. It is well worth thinking of, and well worth what it costs to experiment on it.

Mr. ———. This habit continued when the trees matured and became twenty-five or thirty years old. It was almost the rule.

Mr. FISH. I have a very small orchard, and I would like to ask if it is not possible to so manage it as to obtain a moderate crop of apples every year?

Prof. **Beal.** If you produce a moderate crop, so that the tree grows with vigor, it will be capable of producing a moderate crop every year. I know some trees that bear a small crop every year, but if they bear a very heavy crop one year they are likely to miss the next year. That is the case with most of our trees.

Mr. **Augur.** In endeavoring to change the bearing habit of trees, would it not be better to remove the flowers than to wait until the fruit is formed?

Prof. **Beal.** It would be, undoubtedly, but it is an expensive process to remove the flowers from a large tree. If you wait until the fruit sets you have much less to remove. That is the only reason for waiting until the apples become as large as my finger-ends.

Question. Is there not a natural law which is arbitrary in this matter? Is this alternation in our fruit trees owing wholly to the exhaustion of vigor? If there is not an arbitrary law which influences this matter of alternation, why is it that the trees all over New England this year, of a given variety, are in full bearing, although of different ages? Although coming into fruitage in different years and at different ages, yet they are all bearing on this same year.

Prof. **Beal.** A gentleman here has just told us that he knows an orchard that bore a full crop last year. I do not know the reason why apple-trees should bear so much some years and not others.

Mr. **Cheever.** It seems to me the meeting is getting a little off the question of college education, on to pruning fruit-trees, and the like. I want to ask the speaker whether the Michigan college finds any difficulty in obtaining students? Whether the college is growing in popularity throughout the State, and whether the farmers seem to be willing to help support it?

Prof. **Beal.** I am very glad the gentleman has asked the question. I have been connected with the institution ten years. I do not know much about it previous to that time. This summer I gave a lecture to our students upon this very matter of the growth of agricultural colleges. When I entered upon my duties at the college, we had eighty regular students. The past year we have had two hundred and sixty-five. It has increased more than three-fold in ten years. At the time I went there it was very unpopular. The papers were fighting it throughout the State. Some of the most influential daily papers all over the State were opposed to it. We had to fight for any appropriation by the legislature. I do not know now of a single paper in Michigan (and we have 200 or 300), or a single periodical, that opposes the agricultural college. The most influential dailies are all in favor of it, and all speak a good word for it. This change, I am certain, has been brought about largely by the farmers' institutes that are held in the State, and a good deal is due to the fact that the right men have been at the head of the Granges in the State. The master of our State Grange, and the other officers, are all strongly in favor of the agricultural college. They work for it in every way. If a member of our legislature is not favorable to it, they go for him, so that he does not go to the legislature a second time. They leave him at home, and put another man in his place.

QUESTION. How large an appropriation does the college receive from the State yearly?

Prof. BEAL. I am unable to tell you. It depends upon the new buildings that are to be erected. It varies a good deal in that respect. Last year, for the horticultural department, there was $2,000 appropriated to aid in building a green-house; $6,000 was appropriated to build a new library, for books on botany and horticulture alone, and to contain the museum of vegetable products. We had never asked so much before for the horticultural department, but everything was granted that was asked.

Mr. WHITTAKER. Are those appropriations asked for as the wants of the college require, or is there an appropriation every year of a certain amount?

Prof. BEAL. The State is bound to keep the buildings in repair and build new ones, and it does supply part of the deficiency. The interest on our land grant is now about $18,000 a year. The land is not all sold, and the interest will be still greater as more land is sold. There is no special amount that is given by each legislature; it varies according to the needs of the college.

Mr. Whittaker. The Professor says that ten years ago the number of students was eighty, and the past year they have increased to two hundred and sixty-five. Has that growth been gradual; that is, from year to year?

Prof. Beal. Yes, sir. Certainly it has been, if you take two or three years together. The number varies a little according as times are hard or easy, just as that cause affects other institutions and the general business of the country.

Mr. Whittaker. What I want to know is whether there has been a systematic effort made to increase the number of students, or whether it has been what we call a natural growth.

Prof. Beal. There has been no special effort made.

Mr. J. S. Woodward, of Lockport, N. Y. Let me add a word to what Prof. Beal has said with regard to the popularity of the Michigan Agricultural College. I have a good many friends in Michigan, and my business as well as inclination has taken me there several times during the last three or four years. I am well acquainted with the people all over the State, and I can say that the most popular institution in the State of Michigan is the Michigan Agricultural College.

Adjourned to two o'clock.

AFTERNOON SESSION.

The Board met at two o'clock, Vice-President Hyde in the chair, who introduced as the first speaker Dr. E. L. Sturtevant, of South Framingham, Mass.

THOUGHTS ON AGRICULTURAL EDUCATION.

By E. Lewis Sturtevant, M.D., South Framingham, Mass.

From the web of an infinite past two lines separate, and intersect in the life we call ours, and pass onward into eternity. Why this life we know not, nor whence it came, neither have we volition concerning its appearance or early surroundings. We are here because we must be; it concerns us not whether it were better to be born at all, or whether, non-existent, our uncombined atoms should vibrate in other ways than in ourselves. We are creatures of a past which has never been under our control, and as we are must we take up the problem of the development of our life, and of the influences which, modified and formed by us, shall pass onward to act in the ceaseless ages. This individual life, however, comes to us, and we exist and act from impulses that are coeval with formless time, even as we in turn shall originate impulses which shall be immortal. It concerns us, and concerns our generation and our coming race, as to what we are, where we are, and how we act. We, by fortuitous fortune, live and form portion of a race, where progress has become the god of our aim, and the measure of our anticipations. How progress shall in us become assured is then an important question; and the methods which have become formulated to secure a higher and progressive development of the individual, and through him of society, are known under the comprehensive name of education.

What we are, where we are, and how we are to act, are determining factors in any scheme which is to be formulated for educating—leading or bringing out—the capabilities inherent in the race. In civilized countries there is such a certain connection recognized between the mind and the body that the term education, in ordinary usage, is interpreted to refer to our intellectual attributes primarily, it being understood that the hand is dependent for its best work upon the governing of the brain. The term education also applies secondarily to the training by practice, as when the routine laborer is taught to acquire skill and facility by the constant repetition of certain acts. This however seems to be a misapplication of words, brought about through the necessary connection between the body and the mind, whereby the body is used as a means of access to the mind; as a convenient and often necessary tool for training the mind; as also through the confusion incident to any attempt to separate by an arbitrary boundary the mutual interaction between the acts and the direction of the acts, often inextricably interblended in practice.

The action of the hand, in order to accomplish quickly and readily routine work of simple character, is a matter of training, and in so far as it enables the man to accomplish his ends is eminently desirable; it may be even more to the man than training, but oftener is no more than training. When however it becomes more, and acts upon the mind so as to influence the determining of causes and reasons, it becomes education. The term education, therefore, in our opinion, is applied to that series of acts whereby intelligence which discriminates between and traces causes and effects, and follows sequences in order to accomplish results, is created. The machine which accomplishes simple or complex acts rapidly, successfully, and unerringly, may serve as an illustration of training; the man who invented and formed the machine examples education.

In approaching the discussion of the educational needs of a class, as the farmer, it behooves us to ever keep in mind these distinctions, and to ask ourselves, is what we want training or education? In the one case, the means to the end must necessarily be different from the other. If, however, we desire both education and training, then the means for attaining must also be modified.

The methods of education must be adapted to the people who are to be educated, for in this consideration we have the effect of heredity, whereby nations or classes become developed more or less strongly in certain directions. Thus what we are, the materials for the foundation upon which education is to build, is of a real importance. A finished and complex scheme, which might be the best attainable for our civilization, if transported to the East, might be a series of mistakes if attemped upon the Oriental populations, and *vice versa*. In like manner, a scheme for educating might with us, to a less degree than our contrast perhaps, be successful in one neighborhood, and a failure more or less manifest in another. Hence a wise discrimination must be exercised in the forming of a scheme which shall be adapted to our nation, to our surroundings, and to our future position. It is from these considerations that we are called upon to plan, under the names of classical, technological, scientific, practical, and even agricultural education, a variety of schemes, either of which may be esteemed fitting for its purpose, and yet unfitted for extension into other purposes than that for which it is primarily designed. From the recognition of this consideration as a fact, essentially a modern output in the educational field, has originated this division of educational labor that we see about us.

Any plan we shall formulate, however, must be based, in this age certainly, upon science; that is, upon the just recognition of facts as they exist, and the legitimate connections of sequences as they occur from these facts. The underlying facts, as we claim, are,—that we possess an individuality, both personal and local and national; that we possess an environment; and that aims and objects are a part and parcel of an educated nature.

Accepting the farmer as one of a class, and adapting the current of our thoughts especially towards him, let us ask ourselves the question as to what are his aims and objects, what are his surroundings, and what are the personal peculiarities of his class.

The first object of the farmer, as representing a class, is to make money in order to secure the second object, which is, to benefit his condition: this is a comprehensive term, involving recognition of ease, leisure, luxury, influence, etc., and a varying factor according to the surroundings of the individual. This comes from the pursuit of the farmer, combining business and living. In trade, the business and the home are kept separate; in farming, they become one. The education which shall cover this condition must combine the technical, the commercial, and the æsthetic, not in whole, but in portions of their relations. It must embrace the art of how to raise products, how to treat the farm and the fields, what products to raise, how to meet the market, how to expend on the farm in order to gain; it must include a knowledge of the wants of consumers, and the laws governing prices, of the theory of profits, of the relations of trade; it must not be neglectful of the arts of living, the regulating of the domestic work, the fostering of pleasures connected with the maintenance of the home and the farm, the cultivation of the tastes which shall throw a charm over necessary toil, and fit the possessor to judge from home observation of the wants of others, and thus to supply them. We doubt not but that this idea will find many dissentients, but yet we believe that careful thought will show its truth. The individual and the State require ambitions beyond that of simple coarse food and clothing; this may come to the mere barbarian held to work by oppression. It is the advantage of progress that it looks ever towards new wants, new conveniences, a little more of the good and desirable things of life, and abundance of facilities for exchange. This money brings; this is its beneficial power; this is what education should bring to the farmer, the power of supplying wants ever increasing beyond the vegetative, negative state of existence common to the human animal and the beast; the power of furnishing increasing joys of existence positive in their nature, and somewhat beyond the mere negation of happiness as measured by absence of pain. Hence the farmer's education, in part, should be governed by the knowledge that his aim should be to farm so as to acquire property through his gains, and that his object in the acquisition is to secure not living solely, but comfort, power, and a sharing in the manifold obligations and gifts of what we call social position.

The surroundings of the farmer involve a certain separation—a certain loneliness of position—a certain dependence upon self and the family—a certain largeness of action, in order to secure minute gains—a certain slowness of action, as comes from the close connection with the delays of the seasons, and the changeful nature of natural conditions—a certain weakness in power of combining with others—a certain tarrying behind the wheels of progress. Indeed, the cities are the centers of activity, the isolated populations the conservators of existing conditions. Under equivalent conditions, the closely centered populations press forward, our scattered populations hold back in the forward race upon which the nations have entered, in order to secure first arrival at the scarcely discerned goal of perfectibility. Yet, despite these limitations, the farmer has his duties, and the education for him must take cognizance of the peculiarities of his position. It must be designed so as to give him a greater power in overcoming these difficulties by impressing upon the mind the certainties of science and the sureness of natural laws. It must impress the power of individual action in overcoming and subverting natural agencies to a purpose, and must by thoroughness and completeness in elucidating principles inspire a confidence that shall bring the self-respect which comes through a consciousness of power. It must attempt to make the farmer more of a complete man than would be required for the artisan, by enlarging the field of his thought so that he shall, as a distant observer, if need be, be enabled to recognize the right and the wrong, shall sympathize with the progress of the age, and can criticise the acts of others in their relations to his interests. This education implies the political economy of facts and their applications, not the political economy of any one school. The environment of the farmer is such, in a word, as requires the best and most comprehensive teaching on the part of the educator, and constant practical daily study on the part of the farmer, in order that he shall compete on an equality with the other classes, now more influential than he, of an age of progress.

The personal peculiarities of the farmer must not be overlooked in any scheme. He usually is opinionated and prejudiced, the natural result of ignorance. He is surrounded by others like unto himself. He acknowledges more assistance from his hand than his thought, and possesses a self-consciousness that other classes are better off than himself. He prides himself on being practical, not seeing clearly that intellectual force is more productive, when properly applied, than is brute strength, and hence undervaluing the benefits to be derived from theoretical knowledge. It is therefore expedient that an educational scheme, in order to meet support and accomplish full good, must not shock too greatly these prejudices, and, wherever possible, must endeavor to point out practical uses dependent upon the knowledge which is being taught. We have here the doctrine of object lessons, and experimental teachings based upon field and laboratory practice.

If these considerations be not philosophy, they are certainly justified by the methods of science, which arrives at its deductions through the logic of observed facts. We have for our facts the farmer as he is, the aspirations which possess him, and the difficulties which stand in the way of his progress. If we can agree upon these facts, then it cannot be difficult to form agreement upon the method of securing the farmer's education. We shall see that the farmer requires the very best education possible, and that this education must be general as well as special, and must be presented in such a manner as to be accepted and acceptable to a class already formed, and whose children must be saved from the effects of ignorance in the present competition of classes. Strong language, certainly, and far from complimentary, yet justified by the logic of existent facts.

Upon a general view, the beginnings of our methods of education must be the same for all, viz.: the acquisition of the tools common to those who would be workers in the field of thought. Reading, writing, spelling, the simpler mathematics, are requisite to be mastered as a preparation for any development of educated thought in whatever school or for whatever purpose. Such the intended student of agriculture must certainly possess, and what succeeds these in general acquirements is no disadvantage to our coming specialist. This is to say, the best education of our common schools is none too good as a preparation for the special course of an agricultural college.

And this leads us to remark that an agricultural college, to meet the full needs of the farmer, must have the respect of the general community, and must have a popular recognition of its equality with those other schools of learning which are moulded upon the traditions and experiences of a far distant past. The age of classics is passing away, and the age of science is already upon us. The respect formerly given to authority and opinions based on metaphysics is sensibly weakened, and the doctrine of verification is in its stead. Science, the child of philosophical speculation, is destroying its parent, "as the mythic Zeus, calling the Titans to his aid, destroyed Saturn and usurped his throne." Observation and experiment on the Titans of the new method. The special college, founded for the advancement of uses, practical and modern, neither ignoring nor worshiping but using the past, should stand before the public in no whit inferior to those ancient colleges founded upon, if not now confining themselves closely to, ancient thought. Hence all methods which in the public estimation render an agricultural college inferior in position and learning to the classical colleges, already established as standards, should be entirely discarded, or else wisely shorn of objectionable features, provided such can be done without sacrificing absolute advantages and benefits to a popular idea. Enforced manual labor is now one scheme which is disadvantageous to a college, and a paying farm is the second. Both are injurious to the character of a college before the public of influence who have been educated in literary schools. From the nature of an agricultural education, manual labor, paid for at the market rates as required on the college farm, should be a privilege accorded to students, but never enforced until that day comes, which will never arrive, when the work of the hand shall have a greater respect and a greater value than the work of the brain. A paying college-farm is an anachronism! an idea not worthy of our scientific age. The object of the farm is to afford instruction, and it stands in the same true relation to the agricultural college as does the laboratory to the chemical school, the dissecting-room to the medical college, and the moot court to the law school. When wisdom requires the chemical laboratory of a college to pay an income from sale of manufactured chemicals, when the dissecting-room and the moot court shall be required to pay a profit, then let us demand that the college-farm shall pay,, and not till then. Manual labor, and a profitable farm and garden and greenhouse, are as far from the duties of an agricultural college as the publishing of books are apart from the duties of a literary college, or an actual law court is to the law school.

If the college farm is useful to the college, it is for the purposes of instruction. It is there that what is taught in the class room is to be illustrated, and where the problems of the farm life are to be shown and commented upon for the purposes of instruction. If the labor required upon the farm can serve the student by offering him, by just payment, financial assistance in carrying on his course of study, so much the better; but this is only incidental, and is no more a requisite than it is for the literary college to establish primary schools and academies for the remuneration of their students.

Manual labor and a paying farm tend to place an agricultural college on the level of the farmer's thought, but what is an actual fact, far below the level of the thought of the influential and active community who govern and give form to our prosperity and progress. Enforced manual labor is not necessary to the college farm, but rather a detriment, if paid for at the regular rates of labor, as securing unskilled men in preference to the skilled; it is detrimental to the college by giving a lower tone. It should therefore, as offering no compensating advantages, be sacrificed to the educated sentiment of the community which forms the standards for our judgment. The paying farm means the sacrificing instruction to the demands of an ignorant public. What farmer could succeed if forced to employ labor at the beck of another, without reference to the needs of the farm! To instruct often implies destruction of material. Is it profitable to graft with unskilled labor? and yet it is only through trial that the skilled grafter is formed. Should the college or the farm pay for the instruction? So for pruning. Should the delay caused in plowing through the necessity of explaining the principles of the art, and the art required to do the best work, be charged to the farm or the college? Is it good farming to grow such a diversity of crops, and to form such a diversity of interests, as are required for the purposes of instruction? Should the experiments necessary for instruction be a perpetual drain upon the farm profits? Yes, it is but fair to assume that when a college farm shows a profit, this profit is obtained at the expense of the teaching, and it is but the candid statement of a conviction when we say that a paying college farm is a sign of poor teaching. The farm has been diverted from its purpose of instruction in order to meet a popular claim that the farm shall pay. It has lost its distinctive character as an important element of the college machinery for teaching, and is to be put in the same category as the college laboratory should be placed, if it were leased to a manufacturer, with the privilege of entry and examination reserved. Do we wish to make laborers? Then the college is but aiding in the formation of a peasantry class, from which, thank fortune, our country is yet free. Do we wish to form wise directors of labor? then abandon enforced labor in our colleges, and leave this work for the home and the factory, and the struggle for existence to settle. Labor, for instruction's sake, is to be commended; enforced labor lowers the educational tone.

In an agricultural college each course of study should be arranged for a definite purpose, in order to further the student in the instruction which leads towards the special aims and duties of his future life. Mere literary studies, as such, provided they have little or no application towards this kind of training, should be omitted. Thus logic would be useful, metaphysics unnecessary. So long, again, as time is limited, those studies which have the most bearing on the future pursuit should have the preference, and many desirable studies in themselves must be omitted. In all cases, beginning at the commencement and extending throughout the whole course, the idea of training the thought must be kept in mind, and enforced in all collateral ways. From this point of view mathematics are an important course, as not only serving to train the mind, but also in many of their branches having a direct application upon farm life. English literature, and its correlative composition should also receive attention, as well as oratory. To express one self well in speaking and writing is a gift to be desired by the farmer as well as by each and every good citizen. As to foreign languages, we confess we would not approve much attention to be given, on account of the shortness of the regular course, and the multiplicity of more important branches. Yet in a completely equipped college, the languages should have representation, and'their pursuit should be left optional with the student. Physics and science, in their several departments, should afford the ground-work of the education and tuition. That series of studies which treat of the general properties of bodies and of causes, usually comprehended under the term physics or natural philosophy, afford opportunity not only for the thorough exercise and training of the reasoning powers, and inculcate the highest lessons of successful thought, but as well are to find direct application in every-day life, and are closely allied to all the developments of natural science. The properties of bodies, practical and theoretical mechanics, the physical relations of the soil, the relations and actions of water, heat, light, etc., and the doctrine of forces, are all important to study as bringing acquaintance with the principles which are in constant action, and which as modified in their interaction by the educated mind, are efficacious to control the natural conditions the farmer constantly meets. No less important is the knowledge of the sciences, such as chemistry, botany, physiology, geology, etc. The study of "agriculture," as the term is used in our existing college catalogues, is the object for which our agricultural colleges are founded, and yet, important as it is, must be mentioned last: for the word conveys a complex idea. It infers an acquaintance with all science, in a more or less degree. We cannot teach the properties of the soil with reference to the life, vegetable and animal, which is dependent upon it, without the aid of physics, chemistry, botany, and physiology. We cannot teach the methods of working the soil without calling upon mechanics. The manuring and fertilizing of the soil requires reference to chemistry and physics. The planting cannot be explained in its principles without reference to vegetable physiology. The principles underlying growth cannot be taught without reference to meteorological science, chemical influences, and the action of other physical conditions. If we consider animals, we must know somewhat of animal structure, and employ the sciences known under the general terms of physiology, pathology, chemistry, physics. The conservation of energy doctrine is now of a practical biological concern, and is the philosophy of breeding. The utilization of wastes, and preservation of products, as well as the production of the farm, all require for their best realization a knowledge of the sciences. And so we might enlarge, but this is sufficient for illustration.

Now "agriculture" must be taught; not as an empirical procedure, for such would not differentiate modern progress and modern conditions from those which governed the agriculture of the ancients, whereby in places deserts were produced, and in other regions a steady depreciation in quantity of yield; but according to modern methods, grounded upon that modern science which is founded upon principles derived from the tracing out of causes through carefully observed and verified facts, it must be treated as a modern pursuit, and the most modern methods must be employed in its teachings. As the age of authority is weakened, and is still sensibly weakening, so must we cease, as far as may be, from teaching the young student in the "I say so" manner, and must endeavor, through experimental method and actual illustration, to convince the student personally of the facts, and gradually lead him through correct deduction into general principles, and thus into the means of profitable applications. The teaching of agriculture must, in our opinion, be from the class-room to the field, and from the field again to the class-room; statements must be shown, and deductions must be verified as far as may be, and apparent discrepancies disclosed and explained. The student should be convinced through his senses and his reason, not by the statements of the books alone. This method implies the *use* of the farm, the garden, the glass-house, of trees and plants, of tools and implements, of illustrations of failures as well as successes, and taxes all the resources of the college curriculum. It implies the best and most talented as well as skillful teachers and demonstrators. These remarks cover the study "agriculture," as the word is used in college catalogues, but be it clearly apprehended, it does not cover the term "agricultural college" as a means of educating the agriculturist.

Object teaching is not science; accumulation of facts is not science. Science comes through the connecting of causes and effects through observed and verifiable facts and phenomena. Its line is linear, and each new discovery, each fact observed and connected with preceding facts, carries progress forward and extends the line. Its laws offer data for success, data for prophesy. As agricultural pursuits are carried on in accordance with scientific laws, agricultural science becomes possible, and each success opens up the road for further success; each conquest from the mystery of natural law opens up a vista of possibilities waiting to be grasped, and each for our benefit. To attain this position of science for agriculture requires educated workers, and many of them, and the agricultural education grounded upon scientific methods, not only is eminently desirable for the purposes of profitable farming, but is also to be sought for in the interest of progressive farming.

To sum up an educational scheme, agricultural education must be founded upon the rudimentary and general education of the common school. It must develop the thinking man. It must teach the principles which appertain to agriculture, and the pursuit of farming as it exists. It must show the application of these principles. Its methods must be through teachings of the outlines of the sciences and of the general laws of thought, so as to give to the student control over his own faculties; object lessons, wherein the student shall be directed to the explanation of the causes and effects of the phenomena to be met with in the farming pursuit; practical lessons which shall teach the putting into practice of what is apprehended by the mind; verification lessons, which shall test to the student his own knowledge, how much or how little it may be, and its practical value.*

The CHAIRMAN. Have the audience any inquiries to make of the speaker?

Mr. WHITTAKER. I think we are greatly indebted to this Board for the subject which they have presented for discussion in these meetings; that is, "what the farmer ought to know, and how he may learn it"; and I think that the Doctor made a very wise remark when he said that those farmers who ought to profit the most by these meetings are the ones that rarely or never make their appearance in them. We expect, when we meet the farmers in these conventions, to meet an advanced body of that class of men; advanced in one respect, if in no other, and that is in a knowledge of what they do *not* know and a knowledge of what they want to know. I do not know, Mr. President, but all progress is really contained in those two sentences—a knowledge of what we do not know, and a knowledge of what we want to know. I believe that we shall never be dogmatic when we compare the little that we know with the vast field lying before us yet unexplored; and there is no question relating to any industry that can be brought before the human mind that involves so many intricate questions as that of agriculture. It involves the question of all we are and all that we may be as men here upon this planet, and a good deal of what may be our future in an unknown world yet to be revealed unto us. It is a question of how our bodies are built up, what builds them up, and from whence the material comes. It is a question which involves every science. The Doctor, I believe, excepted metaphysics. Well, as I understand it to-day, metaphysics can hardly be called a science. You cannot dispense with any of the natural sciences and be well educated in agriculture. Agriculture embraces the whole science of chemistry. You cannot get out of it. There are chemical changes going on, many and mighty, in what we would call the filthy manure pile. There are chemical changes going on continually in our own bodies, and we do not know what they are; we scarcely comprehend them. When we take up this question and begin even to think of it, to say nothing of talking about it, we are lost, and the most that we can say is, we scarcely know anything about it. The great question is, how the men of to-day can refuse to support any method or any system which will impart to those who are to take our places, at no distant day, better information on these subjects than we have had. We, Mr. President, in meeting here on this occasion are not meeting for ourselves; it is no question of ours;

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*Each student should have assigned him, the second year of his course, a plot of ground, say 2 x 2 rods, upon which he should be required to pursue a practical course of study upon some one plant, and should study the comparative effects of his own action in influencing growth and product, and the data thus afforded should furnish the material for his graduation essay. On a portion of this plot, he should be encouraged to study the physics of the soil, as governed by climatic conditions, such as drought, rainfall, rain penetration, temperature, capillary attraction, etc. The use of this plot should not be obligatory, but should be encouraged by the judicious use of college marks and honors, and by the example of the teachers. In cases, the substitution of an animal over which the student should have the proper control, and upon which he should in like manner report, would be advisable.

it hardly belongs to us, only as a duty that is claimed of us for those who are to come after us. We are laboring to-day for posterity. We are laboring to-day that those who follow after us shall not have to contend with all the difficulties which we have had to meet. We know the pathway which we have traveled. We know how we have had to struggle, we know how we have had to contend and fight with the obstacles that have met us in our way through life thus far. The question is, Mr. President, whether we really wish that our children shall follow in our footsteps, and have no better material with which to fight the battle of life than we have had. This question of education is an appeal to the people of this generation to provide for the people of the next.

Prof. **Atwater.** May I be allowed a word on a subject very closely connected with, indeed, part of, the one that we are discussing? We have heard about the Agricultural College. Now, would it not be well to have something about the Agricultural School and agriculture in the common school? What our Agricultural Colleges are, as they actually exist to-day and have existed since their first inception in this country, only a few years ago, I do not know that this is a fitting time to discuss; only there is this to be said, that certainly, with the best efforts of the best men at hand, devoted in the most earnest and in the wisest way, so far as we have any right to say, they have not been the great success that some of us may have hoped. The reasons, it seems to me, are such as to inevitably preclude the success that we desire. There has been neither the demand for college instruction nor the supply of the instruction—two very decided essentials. We have got to grow up to that. We have something to learn, I think, from those who have gone before us, from the experience of older countries, where agricultural education has become settled and successful. We have not a very large class of young men who look forward to a kind of farming which consists in the administration of from $50,000 to $2,000,000 of capital. That is the class of young men that they have in those countries where Agricultural Colleges have been the most successful. That is the class of young men who have contributed to the numbers of the students. We want education for the sons of the men who are here, and the men who are all about. We want instruction for our farm boys. The time will come—some of us may see it and some not—when there will be enough of those boys who will have a few thousand dollars behind them and perhaps plenty of capital to look forward to in the future, so that they can afford to go to a school which shall come up to that very commendable ideal which has been presented to us to-day. But we want to come down lower, it seems to me, and meet the farm boys and the farm girls, every one of them. Some one says, "all right; how shall we do that?" "Rome was not built in a day," and an Agricultural School cannot be gotten up in a day; but cannot something be done towards it? Now, it has been one of the pleasantest features of these meetings, that we have had so many men here who are well qualified to give good advice and good opinions upon this question. It is not so much with the expectation of contributing anything on the subject that would be of value myself, but in the hope of eliciting some discussion of this question from those who are older and wiser than myself, that I rose to speak; and at the risk of saying things that are unwise, I will suggest one or two points.

In the first place, it seems to me that we want Agricultural Schools. I will not say that we ought to found new schools, perhaps, but it does seem to me that we ought to be able, before a great many years, to have things so arranged that some of our country academies, high-schools, boarding-schools, those schools that rank just between the common school and the college, shall give agricultural education. I have sometimes said a thing to myself which I have called perhaps a little foolish, but nevertheless I have repeated it to myself and occasionally to my friends, that if I had one or two hundred thousand dollars at my disposal, and wanted to do as much as I could for agricultural education, I would get the control of some educational institution, and then I would see to it that there were some teachers there who had been through a good agricultural college, who had worked on a good farm, and who were enthusiastic in their love of the culture of the soil and the culture of the mind at the same time; men who would know enough of the sciences which apply to agriculture to teach well and enthusiastically the elements to the students; and then I would try to see to it that when the talk was about whether John should go to school this fall, he should be induced to go to that school, and that somehow or other it should be made a little easier for him to get along if he went into the agricultural course than if he went into any other course there; and he should be taught in such a way that when he got through, he should not have lost his taste for the work of the farm.

I was very much struck by an article that appeared in the *Contemporary Review* written by Prof. Thompson, entitled "Is education a hindrance to manual labor?" The author brought together a considerable number of very pertinent facts which showed that the systems of education followed in our colleges and schools did not conduce to the encouragement of the students, after leaving school, to go into any kind of manual labor. Whether that position is right or not I will not attempt to say: I do not think it is inevitably so, but I think the education we have practically does have too much leaning in that direction to give it the highest usefulness for the education of a mechanic or a farmer. What I would have in an agricultural school would be such an arrangement that the boy and the girl should have their natural love for the work that they left at home and for the life that they led there increased and not diminished, so that they should go back home after the winter school, or after the two or three years' course, and be ready to go to work again upon the farm. It seems to me that this is not simply an ideal thing, but is one that might be realized. Certain it is that it is realized in the cases of thousands upon thousands of students in such schools of a lower grade on the continent of Europe.

Now another word about agricultural education in the common schools. I feel great hesitancy about saying much with reference to that matter, although I have thought a little about it, in the presence of these teachers, who know what can be done so much better than I, but it may not be out of the way at least to make the inquiry, whether that feature of education by which the student is brought into direct contact with nature, that feature which we saw exemplified so beautifully on our visit to the Normal School this afternoon, where we saw those experiments made right before us by the students,—whether that idea is not capable of development in such a way that in our normal schools and elsewhere where teachers are trained, they could be trained sufficiently to be enabled, when they go back to the common school as teachers, with the aid of ten or fifteen dollars' worth of apparatus, to make experiments before the scholars, and then take them out in the field, and in like manner, teach them botany and geology, by the side of the flowers and the stones, and bring them along to the point where they could take up a lump of earth, and say that that was something more than a lump of earth. I have thought a good many times that if I were put to-day where I had to make a speech, and wanted to make a good impression, and had to select my own subject, even if it were the Fourth of July, my subject would not be "our glorious country," but it would be a clod of earth. I remember very well, when a student in an agricultural university in Germany, going out with the professor to attend a meeting of a farmers' club, in the little village of Lindenau, just outside of the city of Leipsic. There we met a number of the intelligent farmers in the neighborhood, and a very interesting lecture was delivered. On the way home, as we were walking along, Prof. Knop picked up a lump of earth (it was a bright moonlight winter evening) and went on talking about it. His talk was beautiful. In fact, it was more a soliloquy than anything else. He was not talking to me, he was thinking aloud, about how that earth had been produced, or about how water had got there; what it was that held the water in there; how, when it froze, it expanded and pulled apart the little particles of earth; how by that process and the subsequent processes which followed in the thawing and in the action of the atmosphere upon it, those particles were disintegrated and decomposed, and the lime, the potash, and phosphoric acid, were set free. And then he went on talking about how roots reached down into that earth; how by wonderful processes, some of which we can explain now, but could not have explained twenty years ago, some of which we cannot explain now, but shall be able to explain twenty years from now. How by these wonderful processes, which involve the action of laws as grandly complicated as those that hold the stars in their orbits, that soil was prepared to support the plant, and did support the plant, in its growth so that it might furnish food for men. I believe there are truths of that sort which can be taught to every child in our schools, and it will start them at least in modes of thinking and of reading which will help them to see in the earth which they till something more than so many acres of land worth so many dollars an acre, and will help to lift them up into a higher life, as well as to make more money out of their farming.

Mr. GOLD. I have not yet had an opportunity to present any questions from the box, but there is one question which, as Prof. Northrop, to whom it personally refers, is with us, I venture to bring it into the discussion which is so interesting and profitable. "Was Prof. Northrop correct in stating yesterday, that the farmer's boy does not need a knowledge of the higher mathematics? Such an impression was given by some of his statements."

Prof. NORTHROP. I welcome the teaching of mathematics, in its highest branches, if there be time to master them; but first I welcome the teaching in the school of just those practical elements of science, which our friend Atwater has so admirably set forth; and in my paper yesterday, my aim was to take the average farmer's boys, and the average time they can be in our schools, and I asked the question, Is it worth while for them to devote nine years to the study of arithmetic? They can be put through in double-quick time the methods of computation which you have seen illustrated yesterday and to-day in the Normal School, and the rest of arithmetic is perfectly easy. When they have learned the Rule of Three, and Percentage, if they have occasion to apply any other principles in arithmetic, it is very easy for them to do it, and I believe it is exceedingly unwise to devote so much time to Proportion, the computation of radii, and the other rules that nobody applies in practical life, or not one in a thousand. That is all I mean.

Mr. HINMAN. I put that question in the box, and, as Prof. Northrop is here, I would like to put it a little differently, and ask him whether he considers it more important that a farmer's boy should learn the rudiments of chemistry than that he should learn all of the arithmetic that is contained between the first cover and the last? I mean, the common-school arithmetic. I am not saying, nor do I mean to say, that there is not a single point that he may skip, but I do mean to say, that the important parts of arithmetic for the mechanic, for the farmer's boy, or for the laboring man, are in the latter part of that book. I believe that a farmer's boy should know how to compute the number of bushels in a bin of corn, how large to make his bin to hold a certain number of bushels, and how large to build a cistern to hold a certain number of gallons of water that run from his barn, and not have to write, as a man did, to the Agricultural editor of the *Tribune* to know how large a cistern he must make to hold a given number of gallons, and the editor in his answer gave him the dimensions of a cistern that would hold six or eight times as much water as he wanted to provide for.

These are the things that a farmer's boy wants to know. As far as my experience goes, living on a farm and among farmers all my life, I have found a far different result from what the Professor states. I have had farmers come to me a great many times to tell them how to calculate the number of feet of boards a log would make. It takes a good mathematical education to be able to do that. It requires a knowledge of the higher mathematics to compute the number of acres in the house-lot. I have known a great many farmers who found it necessary to do that, but I have never known a farmer who has considered it necessary to set up a chemical laboratory on his farm. We have had an Experiment Station because we know very well that no farmer can equip and maintain a laboratory. I believe that every practical man, whether laborer, mechanic, or farmer, should learn in the schools so much of mathematics as is necessary in the common affairs of life. I believe it is vastly more important that the farmer should know how to compute the area of a right-angled triangle than that he should know the chemical constituents of the soil in which he is working. If he wants to know how much potash, or nitrogen, or soda there is in his soil, he can send it to the Experiment Station, and the chemist will tell him.

Prof. **Northrop.** I endorse every word the gentleman has said, and every word he has said is perfectly consistent with what I said yesterday. What I said was, if you master the rules of percentage, the rest of the principal rules are very easily and very simply learned. A few weeks with a bright scholar, or an ordinary scholar, makes that a comparatively simple matter; if a solid foundation has been laid in the ground rules and in percentage, why waste nine years on it?

EVENING SESSION.

The Convention met at 7.30 o'clock, and the Chairman (Vice-President **Hyde**) introduced as the lecturer of the evening, Prof. S. W. **Johnson**, of the Sheffield Scientific School.

SYSTEMATIC EDUCATION FOR THE AMERICAN FARMER.

BY PROF. S. W. JOHNSON.

That the American farmer of the future needs an education is not a question that requires discussion before this audience. That he needs a knowledge of his business, a thorough, practical knowledge, no one can deny. That he needs to be able to exercise an independent, an enlightened, an unprejudiced, a safe judgment with regard to the large variety of subjects which his calling involves, is simply self-evident. Information and mental discipline; possession of knowledge and ability to handle it, are the two results of education which every man of business cannot dispense with.

That the American farmer needs systematic education, an education carefully planned and skillfully adapted to his special wants, one that embraces a suitably wide field and one that covers that field, one which therefore excludes or gives second rank to much that is interesting and useful to know, and confines itself rigorously within the limits which a wise consideration shows to be best adapted for its objects—is also plain to every one fairly experienced in human affairs.

The want of the American farmer is not a lack of knowledge. No farmer in the world, statistically speaking, knows more than or as much as he. Nor is he wanting in the ability to handle his knowledge. He can reason logically and acutely upon the facts at his disposal, as becomes manifest when he has occasion to discuss the topics which have principally engaged his thoughts.

But the American farmer's education is not systematic, is not properly balanced, is too fine spun in some directions, and quite deficient in others. He has a great store of facts, or what he regards as such, many of which are half facts or sham facts, and his acuteness and logical power are often of little more use to him than the speed of Rarus would be to a dray-horse.

This is largely the fault, or at least the result, of the schools in which he receives his training and acquires his knowledge. These schools are: 1. The home farm, where he learns the farming practices and theories that have grown out of the experience of his father and his forefathers. 2. The common school, where his systematic education usually begins, if it begins at all. 3. The higher school, or college, where he may chance to study. 4. The business life in which he wins his bread. 5. The various incidental training and informing agencies that he is the subject of, viz., the Farmers' Club, the Agricultural Society, with its Show and Fair, the agricultural books and papers that he reads, the object lessons and the conversations he gets from his brother farmers far and near.

These varied means of instruction and discipline are those which have produced and are producing our good farmers, who may be found in every town and village throughout the State, in numbers of hundreds and thousands. These schools have made many good scholars, and are to be held in honor for it. But are they the best schools that it is possible for us to have? May they not be improved? May we not easily make them vastly better than they are? If there were not some grave defects in our agricultural education we should not be here devoting several days to its discussion. Our means for educating the future farmers of New England stand in serious and striking contrast to those possessed by Germany, Austria, France, Belgium, Italy, Sweden, and even Russia. In all these countries are provided special, more or less complete and extensive, systems of agricultural education; systems into the best of which is carefully gathered, as far as well may be, all that the learner should know, and from which is as carefully excluded that which stands in the way of the student. We have no system. We are not in possession of the arrangements which can ensure that the growing boy who expects to be a farmer shall not fail to find good guidance, in learning his business, at all points.

The best proof of this vital want is the fact that among our most intelligent and experienced farmers, and among the teachers and professors of agriculture in our agricultural colleges, there is discussion and difference, or even profound ignorance, on important questions that have long ago been fairly settled by thorough investigation.

A grievous fault is, then, that we have no method, no machinery at work to secure for the use of ourselves and our children the harvest of knowledge which is continually ripening for us, no machinery for blowing the chaff from the wheat, no crib where the clean wheat, all of it, is stored, to be the seed of better harvests and the intellectual nourishment of those who sow and reap over all our acres. We have no system that can ensure a good agricultural education to the boy who desires and seeks it; and what is worse, none for ensuring that the boys in goodly number shall desire and seek such an education.

We should address ourselves to mend this matter, beginning where the first opportunity offers, but using system, as far as may be, in endeavoring to establish a system.

The agencies that are already at work in educating the future farmers of the State need our first attention. Of these the Common School is universal in its reach; and here evidently is a place where something useful might be done. A difficulty is that there are so many branches urged on the attention of teachers and scholars that it is declared to be well nigh impossible to find room for more. But the State cannot afford that one of her great industries should not be had more directly in view in the education of the children of her farmers.

It is not practicable to teach agriculture adequately in the common schools; but the simple elements of the natural sciences, botany, zoology, natural philosophy, chemistry, and geology, as they bear upon and may be illustrated by agriculture, might easily be taught and made extremely interesting as well as profitable. The usual routine of reading, writing, and arithmetic, has a dullness in it which these studies are adapted to relieve, when they are properly taught, by their appeal to the eye. For their proper teaching some simple apparatus and collections of specimens are needful,—nothing, however, extensive or costly, nothing not easily procurable. In botany, the plants, the roots, stems, leaves, flowers, and seeds of cultivated crops, of common trees and weeds. In zoology, the familiar insects, birds, and other animals, high and low. In natural philosophy, the tools, implements, and machines, the energies and resistances of daily rural life, levers, pulleys, and pumps, the thermometer and barometer. In chemistry, air, water, common metals and non-metals, common minerals and rocks, soils, peat, ashes, starch, sugar, vinegar, phosphates, potash-salts, ammonia, plaster, lime, milk, flesh, bone, blood, are a few of the universal chemicals that every child might learn more about in a few weeks than the average parent has ever learned.

Not only may the elements of these sciences be taught in their agricultural applications, but the pupil might study a share of those topics of practical agriculture which it is most important to be instructed in. The subjects of tillage, the mechanics of farm implements, the culture of standard crops, the management of milk, manures and manuring, for instance, admit of brief handling in such a way that the average boy could learn the essential philosophy of them in a winter's schooling.

The question may be asked, How are these things to be got into the common schools? The answer is, Put them in! The mere reading of a book in which the story of them is simply and truthfully told would teach them to a very useful degree. One of the best parts of the education of children is the interesting matter which they read aloud in school. The giraffe, the kangaroo, the boa constrictor, and other wonderful creatures that belong to strange countries, are not necessary to such instruction. The Alderney, the Devon, the Cotswold, the Colorado beetle, and the codling moth, would answer the same purpose.

But, in my opinion, there is no difficulty in finding room in the common school for the regular study of the elements of agricultural knowledge. I speak from personal experience. I have done something of it myself, and if suitable text-books and illustrations were provided, and the school authorities would countenance and demand the thing. every difficulty would vanish. Of course, a gallon jug will hold only four quarts of milk, and the six hours of a school day contain but three hundred and sixty minutes, but there is always a chance to take the top of the milk and thus to get more of cream and less of water into the jug, and there is in most cases "a right smart chance" of getting more broth and less dish-water into the school hours, if we will put our minds upon it.

I must here insist that the boy while still young should have, not only instruction in agricultural matters, but that the instruction should be systematic. carefully planned and laid out for him, with its beginning, its continuance, and its ending, with the system declared and evident, so that he should be himself caught up by and possessed of system, so that plan, balance, and completeness, should be impressed on him as the rule and habit of his thought and life.

I must also say that therefore his agricultural studies, however elementary they are, should be formulated and presented in a strictly scientific manner. By which, I mean, that each subject should be either developed from first principles, by a logical, *i. e.* reasonable and natural induction, or traced down to first principles by the reverse process of thinking. A careless flinging of incoherent facts at a boy, is to a large degree a waste of time and strength to teacher and taught. The method of the facts is often as valuable as the facts themselves. Information, without the power and habit of assorting it, is largely lost, just as ammunition is wasted, or even hoists one with one's own petard, unless the kind and the quantity of it and the order of its use are suitably adjusted to one's guns.

To begin this work of agricultural education in the common school requires only that the demand for it be made, and be maintained. The difficulties of want of time, want of teachers, want of books, want of apparatus and means of illustration, can all be easily surmounted, if those who have the interests of agriculture and of the State at heart, will only say the thing shall be done, and set about to bring the now available forces into action for that end, and to develop the means needed for its full accomplishment.

With a State Normal School, with three colleges, and various high schools, where all the facilities for instructing in the sciences exist or may easily be provided, there is only one reason why the winter of 1881–2 may not see agricultural studies begun in every common school in this State.

That one reason, if it exist, is the indifference of a people who are in the habit of being told and of believing that New England has the best school system of the world. New England once had perhaps the best system of popular education, but of late years, she has been moving on in that direction slowly, and other countries have overtaken her, or even gone on ahead, in that respect, while in technical education she is fairly in the rear.

We have a Board of Education, and we have a Board of Agriculture, and these bodies have money to spend, and they spend it, and I doubt not that they spend it well. I doubt not that the State gets back ten dollars for every one laid out by those boards. If these two official bodies would put their heads together, the problem of elementary agricultural education, I doubt not, might be speedily and satisfactorily solved, and that solution would be the best thing ever accomplished by them.

Suppose the boys of all ages, and the girls too, in our common schools, should have the opportunity to get interested in and scientifically instructed about the rocks, the sands, the clays, the muck-beds of the farm; should follow the water from its fall as rain through its percolation, its flow and its evaporation; should understand the dew as it appears to be, and as it is; should know the common seeds in their structure, their vitality, their germination; and the plants, how their rootlets penetrate and fill the fertile soil or perish in the infertile ground; what their food is and how they gather it; should learn the mechanism of the stem and how the sap runs through it; how the leaves gather nine-tenths of the farmer's and forester's harvests from the invisible air; how the raw materials of nutrition are worked into organic matters within the plant and thereafter move towards all growing parts to be organized into its wonderful tissues and shapes. Suppose all this, and the like of it in reference to the entire round of agricultural objects, —how quickly would the fathers, the big brothers out of school, and the hired man begin to feel the impregnation of this leaven!

If the boy should be studying out of a book, a plain and accurate account of what the different kinds of tillage, plowing, harrowing, rolling, hoeing, are, with a clear concise statement, when and why each should be used and should not be used, is it not likely that the lesson would be learned and put in practice on the home farm long before that boy-pupil should succeed to its inheritance?

The education needed by the American farmer may thus, I think, begin in the common schools. In my opinion, the State, *i. e.* the people of Connecticut, cannot afford any longer to allow the children of the farms, of the villages, or of the cities, to grow up without any systematic provision for our future agriculture; the real positive *culture* of our soil. When I say that the village-schools ought to teach agricultural studies, you will, I doubt not, perceive that the village has with us a large interest in our agriculture. Many of the villagers of our State own farms, many more own gardens. They need to have their own children fitted for the charge of these lands. More than that, they need labor, now often hard to get, to assist in the culture of their farms or gardens. Our villages, many of them, support manufactories, and produce an annual crop of children, who are now too largely educated for emigration to the cities and the West, or for an indoor and sedentary life. With a suitable impulse from the schools, many of these children would seek or be sent to the land for support, and our villages, instead of shirking the proper treatment of their lands, would begin to employ more labor, to keep more sheep and cattle, to make more manure, to raise more and better crops.

The cities too, should have their share of this instruction. It is in the vicinity of the cities that intensive culture can be made to pay. It is there that fertilizers can be got in greatest abundance, there that land can be kept yielding profitable crops from early spring to latest autumn, there that labor is usually in surplus. There it is too that many a delicate boy goes to the bad for want of honest employment, who might be developing his mind and muscle, and earning his support in healthful out-of-door life. When I see the hundreds of acres of unoccupied land in the suburbs of New Haven, yielding only a little pasturage, and an annual crop of kindling-wood, from its fences ravaged by the small Arabs who ought to be gardening upon it—while I am getting my lettuce and celery from New York and Boston, and cannot get at all the artichokes, the blanched dandelions, the chicory, endive, Brussels sprouts, and other vegetables that in a French city keep perpetual salad upon the table—I cannot avoid the thought, that if the owners of this land, and the growing boys in the schools, knew what health and wealth there might be got from the capital of the one and the skill of the others, this would all soon be changed.

I say that the city school needs agriculture to be taught in it, as well as that of the country. How many a city man who has got a competence in trade, in manufactures, or in a profession, would like his modest country place and would have it but for the utter wreck he is likely to make of it if he undertakes to manage a little land himself, and the difficulty of getting any one who knows how to do it for him. It appears to me that if we gave reasonable attention to the kind of education I am urging, agriculture and gardening might be as easy for the city resident to enjoy on a country place as now they are difficult.

But if the common school be the place to begin agricultural study it is not the place to finish it. We need special schools for the education of our future farmers, schools in which, during terms of six months up to three years, boys and young men can study agriculture professionally, in its theory and rules, and also in its daily practice, schools whose graduates shall *be* farmers and gardeners in qualification and in fact, and such able farmers as to plainly see that no other vocation can tempt them into other lines of occupation.

There have been made, first and last, various attempts in this country to establish and maintain schools of this sort, but at present I do not know that one is in existence. Those that have existed have been private enterprises, and their success has not been so great as to encourage the establishment of others. Such schools cannot be supported—so experience has demonstrated—by the tuition and labor of pupils. Among us those who are willing to study and work in such schools cannot, in most cases, afford to pay for tuition and living.

Such schools—all agricultural schools—must, in this country, and for many years to come, exist—if they exist at all—with the help of private endowments, or of subsidy from the State or other sources.

I have heard from time to time rumors that some man of wealth was contemplating the endowment of an agricultural school. It is devoutly to be wished that this could speedily be done. Unfortunately there are few who are willing to give their money for such noble and patriotic charities, and still fewer are those, willing to give for such an object, that can clearly see their way to so giving that real and enduring good shall result. Bnt there is sore want of such schools, and of the work that they alone can do, and the public spirited citizen who will found and amply endow such a school, and put it under wise management before he dies, will surely build himself an enduring monument, and will set a shining example which will not be long in finding imitation.

We need agricultural schools of various grades, to suit different objects and to meet different wants. It is impossible to know without experience and trial what kinds and grades of schools will best meet our peculiar wants. It is plain that the agricultural college with its three years course of advanced studies, requiring five or six years of preparatory study and an expense of several thousand dollars, is not altogether adapted to our necessities, at present. The large endowments of our agricultural colleges are, I believe, a good investment. These colleges are, I am very certain in fact or in possibility, great national blessings, and are doing, or will do, a work which must be done and which they alone can do; but they are not educating young men to take their fathers' places on the farms. They *are* educating those who will be active and foremost among the future teachers and inspirers of an improved agriculture. They are, or may be made, and will become, centers of light and fire, sources of energy to all the farms and farmers of the land, veritable suns in the agricultural heavens. Without them there can be no free or full or systematic growth in our agriculture. Their good influence is felt in every state where they have been put into honest and intelligent hands. They have perhaps taught few pupils within their own halls, but they have or may have, and will have a wider teaching, whose influence and effect it is impossible to estimate.

In Connecticut the Agricultural college, i. e., the Sheffield Scientific School, has educated many of the sons of Connecticut farmers. It has annually, for fifteen years, given free tuition to thirty young men, citizens of this State, many of whom have been the sons of farmers, but these young men, in most cases, have not chosen to study agriculture. You do not find many of its graduates upon the farms of their fathers, but you will find them in all parts of the Republic, on the railroads, in the mines and mills, and on the public surveys.

The fact is that when a young man spends ten years of hard study and several thousand dollars on his education, he is fitted for, and readily finds a more remunerative employment than Connecticut farming is commonly believed to offer, to one who has no capital but his education. He therefore educates himself away from and not towards the farm.

Thus it has happened that Prof. Brewer and myself, whose duty it is to give the special agricultural instruction in the Scientific School, have sometimes several pupils and sometimes none, in purely agricultural subjects, and so we spend our strength where it is most demanded, he in teaching meteorology, physical geography, elementary chemistry, the use of the microscope and sanitary science, and I on theoretical and organic chemistry.

This result has not been the fault of the school. We laid out a full scheme of agricultural studies, and for a number of years we made some of the most important of those studies obligatory on our students, but the demand hitherto, has not been for them, but for other branches of knowledge not less important. I do not, however, believe that this state of things can last. The Great West has spoiled our old-fashioned farming. But the Great West is better understood than it once was, and our old-fashioned farming with some needful modern improvements, is gaining ground again, and the time is surely coming when it will pay a young man to educate himself well for farming in Connecticut. Meantime our Agricultural Colleges are fitting teachers and gathering and disseminating indispensable information.

I would here say a word as to what is properly to be regarded as success in the Agricultural College. In the present Kingdom of Prussia are seven Agricultural Colleges of the highest class. The two oldest were established in 1847. Of these one is connected with the University at Bonn; has a farm of seventy acres, and cost during 1879, $20,000 to run it, which was $16,000 more than its income from students. It has sixteen professors and teachers, and during the winter of 1879-80, had sixty-six regular students, each of whom paid $60 for the tuition that cost the State $300 to give. The other, at Proskau, is an independent institution, with every possible means of instruction, on a farm of 2,500 acres, taught by nineteen professors, costing during 1879-80, $25,000 for its support, or $22,000 more than its income from tuition. It has fifty-one students, each of whom paid $60 for the education, which it cost the State $490 to supply. These two institutions have had together in their thirty-three years of operation a total of 4,273 pupils or a yearly average of sixty-five pupils each.

On the other hand the Agricultural department of the University of Königsberg, established in 1876, with ten professors and teachers and four acres of land, had twenty students in 1879-80, and cost the State nearly $8,000 for the year's support, or $400 for each student.

During 1879-80 the seven Agricultural Colleges of Prussia, with 113 professors and teachers, taught 456 students, or an average of sixty-five each. The current outlay for supporting these institutions, beyond receipts from tuition, amounted, during 1879-80, to over $71,000, or about $156 per student, exclusive of the salaries of thirty professors, which were provided for from other sources. If these were charged for at $1,000 each the cost per student would be $220. Such is the price which Prussia paid last year for educating 456 Agricultural College students, of whom 123, or more than one-fourth, were foreigners. This outlay, be it remembered, was for current expenses and did not include interest on cost of buildings, grounds, apparatus, and other equipments of these institutions.

The population of this State is about one-fortieth that of Prussia, and at the same rate for its inhabitants, Connecticut, to rank with Prussia ought to have seven-fortieths, equal to one-sixth of an Agricultural College of the highest class, and ought to teach eleven advanced students yearly. Connecticut has much more than this share of an Agricultural College, thanks to Joseph E. Sheffield and Justin S. Morrell, but it has less than this number of agricultural students.

Perhaps if we had the means of giving cheap board and lodgings and of supplying practical illustrations on a small farm, we might have our eleven agricultural students, but until the hand of philanthropy or that of the State supplies means for these purposes, we are, with the best intentions and desires, powerless to do better than we have done.

Our equipment for an Agricultural College of the first class, is so nearly complete that with a comparatively small addition to our endowments, the Sheffield School might be made equal to any in the country, and so soon as our people fairly understand how essential it is to the proper development and balance of our industries that facilities for the highest agricultural education be put within the reach of every citizen, and that this can only be done by costly endowments, or yearly appropriations, I doubt not that these deficiencies will be supplied. We need, however, schools of a lower and more practical grade, requiring less time and costing far less money to attend.

I incline to the belief that a very cheap and useful school might be established among us on the plan of the Winter schools of Germany, occupying the pupils during the five or six months of winter.

Such schools could be made useful by the employment of a single competent teacher, especially if they were assisted by some of our practical farmers who are accustomed to instruct by pen and tongue.

Wherever there is a live Farmers' club or local Agricultural society the organization and support of such a school ought not to present serious difficulties. The first obstacle would probably be want of teachers; some of these would have to be educated. The second obstacle would be want of funds to pay for their services and other needful expenses. It would be entirely the proper thing for the State and the town to pay a bounty to every such school.

In Prussia are fourteen higher Agricultural Schools with three to six years' courses of instruction and an average of ten teachers, nearly all established and partly supported by some agricultural society, county or city, and each receiving from the State $3,750 to $4,500, annually.

There are also eighteen Winter schools, thirteen of which receive from the local authorities or societies from $150 to $1,875 yearly.

These winter schools are no trite affairs in that country. The extent of teaching varies greatly; some accommodate but twelve, others eighty or ninety pupils.

At the Gummersbad Winter school, near Cologne, twelve pupils are taught by two teachers. One, the director of the school, instructs in the natural sciences, agriculture, arithmetic, surveying, leveling, drawing, and composition. The other, the government veterinarian, teaches cattle-breeding, treatment of diseases, and cattle-keeping.

The Winter school at Schweidnitz, near Breslau, with eighty-four pupils, has, 1st, its director who instructs in cattle-breeding, farm management, meadow-culture, drainage, history of agriculture with conversations, exercises in speaking, and excursions, and 2d, a regular teacher instructing in book-keeping, manures and manuring, treatment of various crops, farm machines, agricultural buildings, natural history and culture of grasses, zoology with excursions. Besides these are eleven other teachers, mostly called in from the city schools, who instruct in geometry, chemistry, natural philosophy, vegetable physiology, arithmetic, writing, German, drawing, geography, history, gymnastics, fruit culture, reading, surveying, animal physiology, care of cattle, and horseshoeing. The clerk of the circuit court instructs also in law.

There are several localities in Connecticut where such schools might be established without difficulty, and where most of the teaching needful could readily be had. This is true of our cities and larger villages, where high schools already exist.

In New Britain for instance, with the Normal School and the city schools, in which, already I suppose, all the subjects except the purely agricultural ones are taught, it would be easy to provide for a very large share of the needful instruction. The same would be true of a goodly number of other cities or villages.

For lack of time I cannot enter here into all the advantages nor all the difficulties of agricultural education. I have in this address, thus far, treated my subject mainly in respect to its external difficulties, and have mostly ignored, hitherto, the greatest difficulty of all. I have proceeded on the assumption that scholars are ready to fill Agricultural Schools if they were provided, and the wise and sober of my audience have doubtless been waiting to wag their heads and say, aha ! where are the boys coming from to learn all this fine science and all this beautiful practice ? My friends, are we on missionary ground? Is it a fact that the gospel of a true agriculture still needs to be preached in the villages and at the farmsteads of Connecticut ? Are those who hold the soil going on contented in evil ways ? Is there among us no sense of agricultural want ? Are we utterly dead in energy, utterly broken in spirit, utterly stupefied in intellect, or where life yet stirs, are we faithless as to the coming of any help ? Do our young men see visions and our maidens dream dreams of easy life and large incomes in town and city, not seeing the incessant labor, the unrest, the exhaustion, that must usually be undergone to reach the lowest level of such dreams, and forgetting the ample compensations of the farm and the country ?

Do we forget that without the flourishing country there can be no city ? Do we prefer to throw ourselves into the whirling vortex rather than to float on safe waters ?

If all this be true, if there are no scholars for Agricultural Schools among our children on the farm and in the villages of Connecticut, it is time that we bestir ourselves. If our boys will not at our wish nor at our command, go willingly to learn how to restore our waste places and extort abundance from impoverished fields, let us take them by the hand and lead them to school, and learn with them what we know imperfectly or not at all, and help there to teach what we do know, but what by our lack of interest or want of address we have failed to impart.

To have our common schools in every hamlet in the State arousing the intellectual appetite, creating hunger for the beautiful, enlarging the imagination, setting it on fire .with every noble sentiment and filling each young soul with longings for the society of cultured men, for the wide arena of public affairs, for wealth and name and fame, is all very well and must needs be done. But to fail to show that for the great plurality of men and women, more success and blessing of every kind, more health, more vigor, more wealth, longer life, less wear and tear, less spent and more possessed, more rest, and not less leisure, are to be had on the farm, and in rural life than elsewhere, is a disastrous neglect.

If the schools where our boys study, the books and papers they read, and the various intellectual influences that mold them, have this outcome that there are no boys who wish, and none who can be made, to attend an Agricultural School, then there is something wrong in the seed, the soil, or the sun that nourishes the growing crop of citizens, then there is need of the Agricultural School and of the exercise of every legitimate compulsion and every possible inducement that can be brought to bear on the development of a better taste, of a more healthy demand. We enjoy to the fullest the blessings of liberty. We are untrammeled by the traditions and the oppressions of monarchies and empires. Let us use our freedom so that it does not rust itself away and lose its brightness and its edge. Freedom is worthless without it has restraints and calls for sacrifices.

The ocean shows its grandeur most, not in its still depths, nor on its broad and peaceful calms, but when it frets against the shores that would confine it, or battles with the powers of the air, in angry storm.

The tides rise highest and thunder loudest in the narrow bay that stretches far out with rocky and widening coast, as if to daunt and imprison the agile waters.

We are safest against the sea when we out-ride all its waves, gather all its finny wealth, exchange across its fluent bosom the varied products of all distant lands and bridge its stormy wastes with steamer and telegraphic cable.

So we are safest against despotism when we resolutely use its centralizing energies, its administrative machinery and its taxations to fortify our civilization, to develop our muscle and our mind, to fit wholesome work to our powers, and our powers to wholesome work, to match our industries to our natural resources, to mix shop-work and farm-work, to subdue and renovate our soil. And here if our social forces be drifting us visibly away from the true path of progress, because of the poverty, the blindness, the ignorance, or the discouragement and lack of faith of any part of the body politic, let those chosen or born to give guidance to the State, put around the helm and keep the old ship steady in the better way.

Pardon this hash of metaphor! In that realm of twenty-five millions which is ruled by the old soldier William and his Bismarck, there are 30,000 elementary schools, 500 middle schools, eighty normal schools, 220 colleges, and nine universities, and among, or of these, are seven first-class Agricultural Colleges, fifteen middle Agricultural Schools, eighteen Winter Agricultural Schools, twenty-five Farm Schools, 253 Country Agricultural Schools, and forty or more special schools in gardening, fruit-culture, draining, etc., etc., relating to agricultural objects—a total of 405.

The central government of Prussia spent last year $266,000 in support of its higher and middle Agricultural Schools, and the provincial and local authorities spent $109,000 more on the Lower and Winter Agricultural Schools. This is to say nothing of the vast outlay in the equipment of these institutions. It is a significant fact that out of the seventy higher and middle schools now in operation, fifty have been established in the last ten years.

Poor Prussians! they are not only compelled to know the blessings and practice the virtues of poverty, to learn the drill and perform all the duty of soldiers, to learn to use the High-German language accurately, with a mass of bothersome science of various sorts, but they will soon be obliged to learn how to farm their lands rationally and well, and what a hardship that will be!

We are free, free to be on the one hand if we will, slaves and victims of the stagnant ignorance of ourselves and our neighbors, and we have on the other hand within our grasp, the better freedom and nobler growth that may come from a resolute struggle with the powers of agricultural darkness.

Let us cherish, reinforce, and perpetuate living freedom. which may indeed vegetate in the cold and in the dark, but can only fully flourish when planted beside all waters of knowledge, and irradiated by all the lights of reason.

THIRD DAY.

Vice-President **Hyde** called the meeting to order at 10.30 o'clock, and stated that, in the absence of Prof. Brewer, a paper prepared by him would be read by the Secretary.

AGRICULTURAL SOCIETIES, WHAT THEY ARE AND WHAT THEY HAVE DONE.

BY WM. H. BREWER, PROF. AGRICULTURE IN YALE COLLEGE.

The two great means of diffusing knowledge among men are *societies* and the *periodical* press. These are the two great engines of modern progress ; but as the Agricultural Press will be discussed by others at this convention, I will drop it entirely with merely the remark that in praising the functions and results of the one, I do not wish to be misunderstood as to the merits or usefulness of the other.

All of the greater moral movements of this age, and also most industrial pursuits and vocations, have special *societies* to promote their work, direct their aims and further their ends, and *agricultural* societies are but a phase of this modern movement of the masses of the people.

The changes in farming in these latter times have been so marvelously great that it is probable that there are men now living who have seen in their lifetime greater changes in the methods and appliances of farming than took place in all the centuries before, down from the time when Abel tilled the soil. This change in farming has been one of the developments of the age in which we live, and has gone along with the progress of science and invention, but it has been mostly through societies that the knowledge acquired in modern times has been carried to the men actually on the farms, and moreover, these same societies have stimulated farmers in a great variety of other ways.

We now see so many separate societies at work, with such a variety of aims, that it is hard for us to appreciate how very modern they mostly are, at least in their present form. So, a few words on the development of societies in general, and of Agricultural Societies in particular, will be a fit introduction to what I wish to say of their past work and present uses.

It is only since the liberalizing of governments, and particularly since our American independence, that societies of the kind we are now most familiar with were possible.

Down to within a hundred years most governments dared not (or at least would not) trust the masses of the people to get together and freely discuss matters relating to the common welfare of the community, unless under special restraint of either the state or the church. Indeed, in our own section of the country in our old *records*, "societies" meant church organizations down to the present century, and in other countries, the "Guilds" of the middle ages and the special societies formed for the promotion of particular kinds of productions, were in their nature and methods very unlike those we are to consider now.

There were a few Agricultural Societies formed in the old world quite early. The Society of the Improvers of the Knowledge of Agriculture in Scotland was formed in 1723. The Highland Agricultural Society was established in 1777, and in 1784 became national as the Highland and Agricultural Society of Scotland, and it early established an annual show of live-stock, implements, etc. In 1777, the Bath and West of England Agricultural Society was organized and immediately established cattle-shows.* Societies are said to have been established before 1780, in France and in Holland. Late in the last century, a "Board of Agriculture" was formed in Great Britain, and it was the earnest wish of Washington, while president, to have such established in this. In his message to Congress in Dec., 1796, he recommended the establishment of a national "Board of Agriculture" for the United States. More than two years earlier, writing to Sir John Sinclair, the president of the British Board of Agriculture, he used language which might well form the motto of any modern society: "I know of no pursuit in which more real and important service can be rendered to any country, than by improving its agriculture, its breed of useful animals, and other branches of a husbandman's care." Had Congress listened to his recommendation, and then, when three months later that prince of farmers retired from the presidential office, had he been placed at the head of such a board, we cannot help but picture to ourselves "what might have been," in such an event, and contrast it with what has been in our later developed national "Agricultural Department."†

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* See Smith's History of Pittsfield, Mass., from the year 1800 to 1876, p. 316.

† See Washington's letters of 1794, *Memoirs of the Board of Agriculture of the State of New York*, miscellaneous papers (appendix), p. 55.

I know of no agricultural societies proper, being organized in the American colonies, before the Revolutionary War. But long before that date there were societies formed in the mother country, to promote special objects pertaining to the agricultural resources of the colonies. For instance, a society was instituted in London in 1753, *for the Encouragement of Arts, Manufactures and Commerce.* which published in 1761 a list of "Premiums offered for the advantage of the British Colonies," the object of which was to make the colonies more profitable to England herself, by stimulating the production of certain raw materials she wanted. Such premiums or prizes as these were offered: £100 sterling, first prize, for the production of *cochineal*, not less than 25 lbs., in South Carolina, within three years of 1759. For *silk* in Georgia, (3d. per lb.), for planting and securing *olive* trees southward of the Delaware river, for the production of hemp, barilla, wine, raisins, opium, scammony, etc., etc. Under the stimulus of prizes, and with the facilities offered in part by such societies and in part by the great commercial companies, spices and many commercial and agricultural plants were tried in all the colonies, from Georgia to Massachusetts. Cotton, hemp, millet, rape, kohl, lucerne, sainfoin, poppies, woad, are among the plants tried over and over again in this State, and allspice, pepper, cinnamon, indigo, nutmegs, etc., etc., in the southern colonies long before the Revolutionary War. Some of these failed because of the natural defect of climate, some because not suited to the wants of the colonists, and some, indeed many, would-be industries or productions were smothered by government interference or forbidden outright.

Living in these days of freedom of production and liberty of trades and commerce, when any man can grow what he will and as he will, make what he will, and sell it where he can get the best price, we can have little just appreciation of the legal repressions which the farmers of previous centuries were subject to. A quotation from one of Jared Eliot's "Essays upon Field Husbandry in New England,* will give us an inkling of the limitations and bonds set on the colonists, even here in Connecticut. "A better *Breed of Sheep* is what we want. The *English* Breed of *Cotswold Sheep* cannot be obtained, or at least, without great difficulty. For wool and live Sheep are contraband Goods, which all strangers are prohibited from Carrying out, on Pain of having their right Hand cut off."

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* First essay, 1848, p. 14.

An advertisement in a Pennsylvania newspaper, long after that, of South Down Sheep, says that the seller has animals of the pure breed, but he cannot tell how he got them, from whose flock in the old country they came, who brought them, nor in what ship they came, as it would subject the vessel to confiscation, and the parties involved to fines and imprisonment. These anecdotes are introduced to compare those times with our own, where we have separate "societies" and "associations" to promote the breeding and push the sale of nearly each and every separate breed of improved stock,—what chance for such societies then?

There was a society for the promotion of silk culture in this State, formed about the middle of the last century. I do not know the precise date, or whether it related to the whole State, or only New Haven County. Eliot speaks of it in 1759, when he was one of the officers to distribute the premiums it gave. The attempts to grow silk were prolonged for many years, particularly about New Haven, and statements occur which lead us to think that at one time mulberry trees were planted along the north side of the public green in that city, and the Connecticut Journal, of August 25, 1790, says that "about sixty families within the city of New Haven, during the present season of 1790, wherein about 420,000 silk worms were raised by the following persons," etc., and then follows a list of the persons, and the number of worms raised by each.

It was not until after we had achieved our national independence, and the country began to rapidly grow under the stimulus of its newly acquired liberty, that any of the agricultural societies began to be formed, which were the parents of those we have now. Even after the political state of the country was favorable, it took a long time for the people to learn how to form such societies, how to run them successfully, and how to profitably use them.

It is uncertain where the first American Agricultural Society was formed, or when. Some say that the first was formed in Charleston, S. C., in 1784, while others date the founding of this society in 1795, thus making it the fifth in point of time.

As to others begun in the last century, we have fuller data. "*The Philadelphia Society for the Promotion of Agriculture*" was instituted in 1785, and is still in existence. So far as I know, this is the oldest agricultural society in America.

Of more interest is the experience of the next society, as it illustrates so well both the changes as adapted to suit the times, and also the results.

The next movement was "At a Meeting of a respectable Number of Citizens, at the Senate Chamber, in the City of New York, for the Purpose of instituting a Society for the Promotion of Agriculture and Manufactures; Mr. Chancellor Livingston, Mr. Simeon De Witt, and Mr. Samuel L. Mitchell," were appointed a committee to prepare rules and regulations. At a subsequent meeting, held February 26, 1791, the celebrated "*Society for the Promotion of Agriculture, Arts, and Manufactures*" of New York was formally organized, adopted rules, and chose officers. The eighth "Rule, provided for a Committee of Publication," to select such of the papers and works of the society as merited printing, and in 1792, the first volume of "*Transactions*" appeared, followed from time to time by others. These were small quartos, and, so far as I know, were the beginning of that great mass of literature, officially put out since by our various agricultural societies and kindred organizations, and in quality of material and soundness of doctrine might well stand as a pattern for some of its modern descendants. These "Transactions" were so sought after, that a second edition was published in 1801, in the more convenient octavo form which all the official "agricultural reports" I am acquainted with, have since followed.

The seventh "Rule" provided that "the society shall parcel the State into districts" with a special secretary in each, and this led in due time to the formation of county societies, of which more anon.

The society was incorporated by act of legislature, March 12, 1793, but the society expired in 1804 by the limitation of its charter, and April 2d of that year an act was passed incorporating a new "Society for the Promotion of Useful Arts, in the State of New York," with essentially the same officers that the old one had, the Hon. Robert R. Livingston being president from the beginning in 1791, until his death in 1813, after which he was succeeded by Simeon De Witt, formerly vice-president. Three octavo volumes of "Transactions" were published between 1807 and 1818, at which date it closed its existence. It was less distinctly agricultural than its predecessor, but "although the title of the society points at the useful arts generally, it is intended to consider agriculture the chief." * But, as a matter of fact, the society interested itself more in manufactures, and in 1808 an act was passed giving prizes or premiums for the manufacture of woolen goods, to stimulate both agriculture and manufactures. The first awards, in 1809, went into twenty-two counties, in 1810 thirty-two counties competed, and in 1811, thirty-nine counties. Meantime, merino sheep began to be grown, and the next year, 1812, a new law was passed giving premiums for broadcloth, to encourage the raising of merino sheep as well. This society expired by limitation, and Governor Clinton, in his annual message, January, 1818, recommended the establishment of a "State Board of Agriculture," a measure long before advocated by leading farmers. The politicians opposed it, and combining with such suspicious farmers as feared that such a board might lead to a landed aristocracy or some other evil, they in March of that year killed the bill by this amendment: "Be it further enacted that the farmers of this state be permitted to manage their own farms in their own way." You notice that the fathers of the modern politicians were already in the field, and a writer of the time says that the amendment "was carried by a thundering majority." But the matter would not rest and the next year, April 19, 1819, a "State Board of Agriculture" was created and an appropriation of $10,000 was made from the State treasury to aid the county societies in offering premiums. This was, I think, the beginning of State aid to county societies. This board published three volumes of "Memoirs," the first in 1821, the last in 1826. This board ceased to live in 1825, and a legislative committee reported that in the six years of its existence the total amount appropriated by the State and expended by the societies amounted to upwards of $52,000,* of which over $46,000 was paid to county societies. These various agricultural societies, more than any one other cause. secured to New York the leading rank in agriculture, population, and wealth. I find, in the publications of that time, very frequent allusions to the importance of preventing the "depopulation," by farmers emigrating further westward, as was then going on to such an extent from New England. And the argument then used was that, the way to do this was to improve the agriculture at home. It was then claimed that this action of the agricultural societies was not only improving the agriculture but was preventing this depopulation (as it was called) and that it called emigrants from other states. As a matter of fact, New York, which was the fourth state in population in 1790, and the third in 1800, had come to the front by 1810, and has since remained the "Empire State." The act creating the State Board was amended March 24, 1820, and the charter expired in 1825. There was no society organized to take its place until 1832. Feb. 14th of that year a convention met at Albany, at which thirty-one counties were represented, and means taken to organize a society, and as a result, the "New York State Agricultural Society" was incorporated by act passed April 26, 1832. This act was amended Feb. 10, 1841, giving the society essentially the shape it now has. Now it began to hold annual exhibitions, since so noted, and to publish those volumes of "Transactions" so familiar in all agricultural libraries.*

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*Transactions of the Society for the Prosecution of the Useful Arts, 1, p. 4.

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* Memoirs of the Board of Agriculture of the State of New York, III, p. 553.

To return to the earlier societies. The next society in the United States was "The Massachusetts Society for Promoting Agriculture," which was incorporated in 1792, and "diffused much practical information by means of a series of papers known as the *Agricultural Repository*," and afterwards by a publication styled the *Massachusetts Journal of Agriculture.* This, too, after changes suggested by experience, is, I think, still in existence.

The next society was organized in this State in 1794, of which I will speak more fully by and by.

So far as I have learned, these five societies were all that were formed in the first twenty-five years of our national existence.† Some of them extended their operations beyond their own State, the Philadelphia society awarded a gold medal in 1790 to a Rhode Island farmer and the Massachusetts society did the same to Col. Humphries in this State, for his importation of merino sheep.

In the centennial year, the U. S. Commissioner of Agriculture published a "List of Agricultural Societies and Farmers' Clubs * * * on the books of the Department of Agriculture, July 4, 1876, being the Centennial year of American Independence." I have enumerated the only societies, five in number, formed during the first quarter-century. According to the list referred to, of organizations in existence in 1876, and on the books of the Department, sixteen were formed in the next quarter-century, 1802 to 1826 inclusive; 376 in the next quarter, 1827 to 1851; and over 1,500 were formed in the last quarter, 1852 to 1876. In this list, forty-seven societies are enumerated in Connecticut, of which only six were organized before 1850, and seventeen before 1860.

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* See a "History of the Agricultural Associations of New York, from 1791 to 1862," by William Bacon; see Trans. N. Y. State Agr. Soc., Vol. XXIII (Vol. 1863), p. 143 to 169.

† I have seen allusions to societies, before 1795, one at Burlington, another at Halifax, etc., but I have no other data relating to them than mere allusions.

Inasmuch as one of the original five societies on this grand list started in this State, something more of its history may interest you. Its "Transactions" published in 1802 tells us that "A number of citizens, from different towns in the State of Connecticut, convened at Wallingford, on the 12th day of August, A.D. 1794, for the purpose of forming a society for promoting agriculture; and having shown their approbation of the plan proposed, appointed a committee to draft a constitution for the society and report to the next meeting. On the 11th day of November, 1794, the committee, before appointed, reported," etc. In short, the society was organized. They published one volume of "Transactions of the Society for Promoting Agriculture in the State of Connecticut," in 1802, a quarto pamphlet of but nineteen pages of printed matter. I infer that its first president was James Wadsworth, as I find his name under the advertisements calling meetings in 1796 and for some years later. It met at various places, at Wallingford, Cheshire, New Haven, etc., and extended its influence and operations over various parts of the State, although most of its meetings (if not all) were held in New Haven county. A new constitution was made in 1803, and its business records exist in manuscript from that date. A library was started in 1807, but I cannot find what became of it or that the papers read at the meetings have been preserved. Advertisements for calls of meetings as early as 1799 speak of it as "The Agricultural Society of the State of Connecticut," and the manuscript records state that Sept. 10, 1817, a committee was appointed to apply to the Legislature for an act of incorporation, which committee reported at a meeting on March 10, 1818, that the Legislature had "declined incorporating us by the name of The Connecticut Agricultural Society, but were willing to grant an act of incorporation under the name of The Agricultural Society of New Haven." The society voted "to accept such act and name," and it still exists as the flourishing *County Society* of New Haven. But two* societies in the United States are older, but this has had a continuous, living existence from the time of its first organization to the present without other break than came from the act of incorporation which changed its name and in effect restricted its operations to one county.

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* When this paper was read I believed that the New Haven Society was the oldest living in the country, that is, had had the largest continuous existence without a break. I have since learned that "the Philadelphia Society for Promoting Agriculture still exists and meets monthly." Whether its ac-

But its influence has been much wider. What it has been on the state and on the world we can never know; but my belief is that it has been especially great and far-reaching. Col. Humphreys was long an active member, and for a time its president, but the society had been in existence, and was moving our farming interests for eight years before the importation of his merinos, and nearly twenty years before those other importations of merinos into New Haven, which several importations practically laid the foundations of the so-called American Merino Sheep, which breed has done more during the last forty or fifty years to improve the wool of the world than all the other breeds combined.

And we can trace its influence in other directions also, not only in the prosperity of this State, for it was active just at the time when Connecticut was powerfully influencing the West through emigration from our farmers, and perhaps the South also, through the cotton-gin.

It will be noticed that during the first twenty-five years, the few societies were general, and belonged to states. If any county societies were formed before 1800, I have no account of them, but very soon after that we hear of them, and their formation characterizes this second period. I think it probable that the first county societies were started on the Hudson river. The famous Berkshire (Mass.) society started in 1807. The beginning may be said to have been the exhibition of two merino sheep, "under the big elm tree," in the fall of that year, by Elkanah Watson. Its first formal cattle-show, however, was held in September, 1810.*

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tivity has been continuous from its beginning, I have not learned. I have also learned that "The Massachusetts Society for Promoting Agriculture" is yet in existence. The dates of the acts of incorporation of earlier county societies in this State are as follows (Laws of Conn., Vol. I, p. 37 to 41): "The Hartford County Agricultural Society," October, 1817; "The Agricultural Society of the County of Litchfield," May, 1818; "The New Haven County Agricultural Society," May, 1818; "The Windham County Agricultural Society," May, 1820. The "Connecticut State Agricultural Society" was incorporated in 1852.

*For many facts relating to the Berkshire Society, and the formation of county societies in New York, see Elkanah Watson's "History of the Rise, Progress and Existing Condition of the Western Canals in the State

This was not the first cattle-show in the country (as many believe), for the *Ulster County Plebeian*, (Kingston, N. Y.), in a notice of that show,* says, that "the laudable example exhibited by our sister county of Dutchess, in instituting a society for agricultural fairs, has been adopted in various parts of the country, with a zeal that insures the most extensive benefits," etc. The work went on actively, and Elkanah Watson says,† "on the 22d of October 1819, the first boat sailed on the Erie Canal from Rome to Utica. It was drag'd by a single horse, trotting on the embankment, in the tow-path. It was an elegant boat, constructed to carry passengers. . . . . The scene was truly sublime. . . . . This was a proud month for the State of New York. While *new agricultural societies were exhibiting in every direction*," etc., etc.

The fact that at the organization of the State Board of Agriculture of New York, January 10, 1820, twenty-six county societies were represented by their officers, gives us another view of the activity of that period, and an article "on the utility of cattle-shows," by the President of the Massachusetts Agricultural Society in the *Massachusetts Agricultural Repository and Journal* for January, 1825, says, "it is no longer necessary to justify these exhibitions, since fifty millions of men in Europe and America have sanctioned them by their adoption," that in France there are about ninety (one in each department), in England not so many, but they are numerous and very efficient, "and the United States have at this moment nearly fifty public exhibitions of this description."‡

Plowing matches also began about this time, along with the fairs. The first plowing match I know of in this State is described in the *Connecticut Journal* (New Haven) of July 12, 1810. It took place on the Fourth of July, started by "the farmers, shepherds, mechanics, and manufacturers, in Col. Humphreys' employ." The account says, that "at dawn of day, in a field of eighteen acres marked out into lands of one acre each, fourteen plows started, each in its own land," etc. The first prize was won by a farmer

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of New York, ... together with the Rise, Progress and Existing State of Modern Agricultural Societies on the Berkshire System," etc. Albany, 1820, p. 105 to 210.

* See Smith's "History of Pittsfield," p. 318.

† Watson's History of the Western Canals in the State of New York, p. 79.

‡ Memoirs of the Board of Agriculture of New York, Vol. III (1826), pp. 139, 140.

who used oxen and had come three miles, and who finished his acre before nine o'clock. Horse, mule, and ox teams were used. The dinner for one hundred and fifty-two persons was "prepared hot on the ground by means of a portable Rumford kitchen." The account cited goes into full details of the affair, which, although not under the auspices of a *society*, yet shows the drift of the times.

Agricultural balls too came into fashion during this period, in connection with local societies, and Mr. Watson gives some amusing anecdotes of the haps and mishaps arising from them, particularly of his sending a package of such ball-tickets to the president of a county society in New York State, who chanced to be a Quaker, and the package was unfortunately opened by his good wife, who was a Quakeress preacher of some repute, to the great dismay of the family and confusion of the zealous sender.

During the next quarter century, 1827 to 1851, societies multiplied by hundreds, and town societies and farmers' clubs began to be noticed. It is possible that farmers' clubs began much earlier, for I have found in the *Connecticut Journal* of March 30, 1791, reprinted from the *Gazette of the United States*, a letter about a *Farmers' Club*, but whether this describes a genuine club in operation, or merely what might be, I do not know, nor have I any data as to when these useful organizations actually began.

I have spent so much time on this historical sketch, because I felt that it was important for an intelligent grasp of the real uses and functions of agricultural societies, and under this head, I include all organizations which have for their immediate object the promotion of the interests of the tiller of the soil or grower of live-stock. They are so numerous, so varied in their character, so wide-reaching in their operations and influences that it would take more than one lecture to describe their mere characters and special aims.

We have national societies and associations of various kinds. State agricultural societies, boards of agriculture, regional societies (like the New England Society, or that of the Ohio Valley), county and town societies, farmers' clubs, horticultural societies and fruit-growers' associations. Cotton-planters and cane-growers have each their associations. There are dairymen's associations and various kinds of organizations devoted to live-stock. Nearly every improved breed of live-stock has its particular and separate society to promote its interests, Ayrshires, Merinoes, Short-horns, Berkshires, trotters, etc., etc., has each its society or association. There are poultry societies and pigeon associations. There are granges and congresses, and so on—indeed, it seems as if each and every department and sub-department of this great industry had its special organization, to promote its particular interests in such ways as the associated wisdom of the society can suggest, and the combined powers of its members effect. And these differ as widely in their scope as in their aims. Some are as broad as the nation, others as narrow as a neighborhood. Some are so general as to relate to everything that is grown on the farm or that can be used there by the farmer and his family. Others are as special as a single breed of pigs. In numbers, probably more than 2,500 of one kind and another exist to-day in the United States.

Now, how have they operated to promote agriculture and educate the farmer?

I will not claim to tell *all* the ways, nor give in detail all their beneficent workings. I hope to call attention to enough of them to make you all think of other ways which I have left out, and which possibly may have not occurred to me.

First, and most important, they get farmers together to learn from each other, each to see what others are doing and how they do it, and to have their wits sharpened by the rubbing of mind against mind.

The farmer's work is most of it solitary, or nearly so; at least, it is not performed by large numbers of men together. From the very nature of the vocation, farmers see little of each other directly in their business. The merchant, the manufacturer, the professional man, each is thrown in contact with many other men of various vocations, and with men of their own calling. They are also thrown into very sharp face to face competition, amounting to almost conflict. The battles in the professions and in the arenas of trade are mostly battles between *men*. It is individual intellect opposed to individual intellect. But from the necessities of his calling, the farmer's battles are mostly with the forces of nature. and where he carries on his fight comparatively alone and in silence. He thus learns to rely so much on his own private judgment, or it may be on his individual whims, that he is particularly liable to overrate his own judgment as compared with his neighbor's, and as a consequence to think that his own ways and methods are the best, and that his own experience is better than that of others. It is this that makes the calling so very conservative.

This tendency is perhaps increased by their actual intelligence in this country, where the farmers as a class are more intelligent, in the best sense of that word, than any other class which has so much of hand labor (or, as we call it, "hard work"), to perform. Combining the offices of overseer and manager of the business with that of the skilled workman, he is at once the employer and the laborer. He must be personally familiar with a greater variety of manual operations than any other laboring man or mechanic is required to know, he must exercise his judgment in a greater variety of ways, and, as before said, with less contact with other men than other business men have,—all this makes him peculiarly liable to underrate the experiences of others and to become prejudiced in favor of his own ways.

Now, there is one, and only one way to remedy this, and that is, to meet his equals, his peers in his own calling, see what they do, how they do it, and with what success. For this purpose no other plan has yet been found so efficient as agricultural societies and exhibitions, of one kind and another.

Theoretically, it would seem as if all this could be got from the printed book or agricultural newspaper. These should be in every farmer's house, and have their effect; but they do not and cannot do the work I am speaking of. We need to meet men face to face, talk with them, wrestle with them in argument. It is so in all other vocations; it must be so in ours. It is just as in teaching and spreading religious truths: the printed tract can never take the place of the preached word, nor the religious newspaper ever take the place of the living preacher. Actual progress is most rapid when both go together.

Next in importance, men are educated by seeing things. It may be tools or machines to do work, it may be animals, it may be fruit, and along with this is the stimulus of prizes to establish standards of excellence. The stimulus of premiums is not to be measured by the money value of the prizes won. Here, as everywhere else, a *prize* won, means a victory won, and it is this which gives it its chief value. I question if all the money won at agricultural fairs more than half pays the actual expenses of the winners in entering the object exhibited, caring for it there, and getting it home again. It is not the *cup*, won at a boat-race, that incites young men to do so much labor, spend so much time and money, and exercise so much self-denial while training, but its possession is the sign of *victory*—and so of the prizes won at our fairs.

In previous ages the stimulus of rivalry did not work so strongly among farmers as among men in most other vocations, partly because of oppressive laws, and partly because of the state of society, but now agricultural societies and exhibitions are stimulating this, because of the call for excellence in such a variety of products; indeed, a successful fair must offer many premiums, for many things, and be attended by many people. The very *crowd* educates itself, and what a remarkable kind of crowd it calls together! Where else and when else do we see such vast crowds with so little disorder, and so little need of police repression, as at our modern fairs or exhibitions?

Again, with modern means of production, competition is sharper than ever before. Steam transportation has put the farmers of widely separated regions into direct competition with each other, and now they need societies and exhibitions even more than before to bring them into contact with new and competing methods.

When agricultural societies began, there was but little agricultural literature, and they published but little before the second quarter-century (1802 to 1825), into which I have divided my historical sketch, and this second period is the most instructive for us to consider, as it shows so well *how* societies work in diffusing knowledge, and *what* the effect is, for that quarter closed before railroads and steam-power and other modern things had affected agriculture in this country, and before we had any distinctive agricultural press, for of all our present vast accumulation of agricultural literature, a very small proportion indeed was printed before 1826.

Three of the five original societies of the first period, ceased to exist in second period or else changed in their methods. They were either reorganized to adapt themselves to new conditions, or they simply ceased to exist, to give place to a new society better adapted to the work, for it was usually easier to form a new society than to remodel an old one. It was during this second period that the societies began to be formed of the kind we are now familiar with: meetings for papers, discussions, exhibitions and fairs, with prizes and premiums, and at the close of the period, they were well at work. A few tools and implements were exhibited at the meetings in Albany as early as 1796 or 1797, and probably at the other societies also; but regular exhibitions and cattle-shows, such as we know them, began in this second period, and at its close, it is said that fifty societies had held exhibitions.

Now, what was the actual result of all this? What was the state of agriculture in this country at the close of this period of a quarter-century in 1826, compared with its state at its beginning in 1801?

First and most wonderful was the rapid and universal introduction of better farm tools, implements, and machines. At the beginning of this period, the wicker fan, the wooden plow, wooden pitchfork, and the hand-rake, were in universal use, the cradle had as yet but partly supplanted the sickle, the grain-drill was known but not used, the flail or the tramping of animals were the almost universal means of threshing. All of these had been invented before, some long before, all were known to a few persons in this country and yet *very* few used them. To the mass of farmers at the beginning of this period they were practically unknown; at its end they were in common use, and except the grain-drill and threshing-machine, the new and improved implements had entirely supplanted the old and former kinds, and the methods of farming were practically revolutionized. Why, even four-wheeled wagons were rare in this State at the beginning of this period; many whole towns were without a single one until long after 1801. For many years I have been questioning old farmers about the tools and farm-implements of their boyhood, and the date of the introduction of improved kinds, and they all tell practically the same story, that the implements had long been known or heard of, then some would be exhibited or used at fairs, soon every one began *talking* about them, a few enterprising farmers would buy them, and then, almost suddenly, everybody else would want them. Of all these, the cast-iron plow perhaps wrought the greatest change, and met too the greatest opposition to its introduction. Yet in fifteen years from the time it began to be seen, it had found its way to perhaps nineteen-twentieths of the farms.

Remember that all these tools and machines had been invented and somewhat used before, why were they not *generally* used before, and why did they then spread so suddenly into common use? What was the moral agency which so rapidly changed this most conservative of industries? My own belief, founded on a careful study of the agriculture and agricultural features of that day, is that the great moving agent in this revolution was *agricultural societies and their exhibitions*; other elements helped, of course, but this was the great one.

The agricultural newspapers, now such a means of carrying useful information to the farmers' houses, then scarcely existed at all. It was the *seeing* of things and talking with the persons who used them that led to the rapid introduction of better tools and machines. Men would see them at the agricultural exhibitions, then would talk about them, then use them, and once used, men would never go back to the poorer methods again.

The next most important influence (perhaps the most important in the end although not so obvious at first), was that it destroyed the intense prejudice against what was stigmatized as "*book farming*," and this paved the way for agriculture to practically apply the truths of science. When these societies began, this prejudice existed all through the masses. How very intense it was and in what contempt book farmers were held, we find hard now to appreciate.

But just before this century began, these societies began to publish papers, "memoirs," "transactions," pamphlets, and other documents. As these mostly emanated from farmers themselves, many of whom were men well known as statesmen or venerated for their patriotism, and as this printed matter was put out by societies composed of farmers, they broke down the prejudice against "book-farming," so-called—at least, against books about farming, and as that prejudice melted away it left the soil of the public mind ready to receive the truths of science; it also paved the way for the agricultural newspaper. These would have been useless before. Agricultural societies had to plow the soil first, and turn it up to the light, and it was like the breaking up of an old sod. But when well broken, science might furnish the seed and the agricultural newspapers scatter it, and find a congenial soil for it to take root. If societies had done nothing else than this, it would have been a glorious result in itself, and well paid for all the work it cost.

Moreover, the societies themselves have been a great source of agricultural literature; the immense mass of official "Reports" that have been printed doubtless contain much chaff with the grain, but in all farming operations we must clean the good wheat from the worthless chaff, we must weed our fields and weed our stock; so too, if the literature of our societies has to be winnowed, that is no sign that it lacks good grain.

Again, the getting together of the influential men of this class, tended to impress farmers themselves with the importance and dignity of their calling, and this I think was no small gain. Washington was an officer in one society, John Adams was at one time President of the Massachusetts society, Mr. Madison delivered addresses before another; it is only in modern times, and only a certain class of modern newspapers that sneers at a president of the United States for delivering "the address" at an agricultural exhibition, or even encouraging it by his presence. Many a man has been cheered in his calling when he sees what respectable company he is in.

Again, the societies did much to improve the varieties of grain; or rather, to spread the knowledge of the better kinds. In accounts of the meetings of societies at this early period, I find frequent accounts of improved varieties of grain being exhibited, and often of seed being distributed. It is mentioned that farmers took home with them new kinds of grain to try them.

Along with this was the decrease in the cultivation of certain old-world plants long tried here, but which we now hear nothing of. Indeed, in the publications of these very societies, in New York and New England, we find papers on the cultivation of lucerne, vetches, spelt, rape, spurry, poppies, madder, woad, etc., etc. Some of these plants had been under trial here for more than a hundred years; and under the old system of things we would have been trying them yet, had it not been for these influences at work which tended to eliminate the least profitable, by teaching to profit by the experiences and failures of others.

With live-stock the good effects were even more marked than with grain; for at the fairs the better kinds of animals would be seen by the farmers present, the breeds compared with each other, intelligent discussion provoked, and the public thus educated as to what good stock really was; every one could see it, and see the differences between the good and the poor. We find all over the country importations of all kinds of improved animals. Then was that great importation of merino sheep, as well as other breeds; short-horns and various breeds of stock began to come. Frank Forester says that there were more thoroughbred horses in this country before 1820 than there were thirty years later. But it was with sheep, cattle, and hogs that the effect was the most marked.

I well remember the first short-horn bull I ever saw. A new county society had just been formed, my father was one of the originators and officers; a fair was held, and a short-horn bull was exhibited. An illustrious farmer of that county, Mr. Ezra Cornell (later the founder of Cornell University), had just bought the bull "*Arab*," the first thoroughbred short-horn that was brought into that county. I was a very small lad then, for that was over forty years ago, but I well remember the crowds that stood around that animal all day, the curiosity to see a bull that cost several hundred dollars, the critical eye with which he was examined, and the comments on him. The society had offered a big prize—I mean big for such a society—for a short-horn bull to be shown at that fair, and that prize, I afterwards learned, was the incentive to that bull's introduction just then. That bull was the *lion* for that day. But the farmers were not so well satisfied with scrub stock after that; in a few years short-horns were no curiosity there, and the improvement in the quality of the stock in the next twenty years was worth several hundreds of thousands of dollars to that community. I dare say that half of the older men who now hear me could tell some similar story. Elkanah Watson bought two merino sheep in the fall of 1807, and as they were the first introduced into that county he exhibited them under the big elm in Pittsfield, and that started the celebrated Berkshire society.

I need not dwell on the influence fairs still have in spreading a knowledge of machines and appliances; the host of agents at every fair, however small, with all kinds of machines, from a patent apple-corer or pot-washer to a steam thresher or patent ditching-machine, is evidence enough that the manufacturers of to-day believe, from experience, that this is a great and sure way to get a knowledge of their wares before the people. And we all know the eagerness of breeders of fine stock to exhibit and thus advertise their animals.

Again, no other one thing has done so much to spread a knowledge of fruit and good vegetables among farmers and to stimulate their cultivation, as well as to educate the people as to the character and appearance of the different varieties. I have included the modern horticultural societies in this general sketch, for they are so intimately connected; moreover, all the principal agricultural societies have a horticultural department, and the exhibition of fruit and vegetables has so long been made a feature that the common style of cheap wit expended on agricultural exhibitions, is to allow them as mere shows of big squashes or overgrown turnips.

Not the least of the beneficent effects of annual exhibitions has been the effect on the farmers' families, particularly on the boys. After the harder work of the summer is passed, how the "fair day" is looked forward to as a grand gala day, and after it is passed, how much there has been seen and heard to talk about. It would indeed be a sad day for farmers' boys if fairs were abolished.

I shall say but little of the more special associations, important though they are,—I mean such organizations as poultry societies, horticultural societies, associations for the cultivation of special crops, or for the promotion of special breeds of live-stock. Such associations have done great work, and they must continue to increase as farming becomes more and more specialized.

This tendency to greater specialization, that is, to the growing of fewer and fewer kinds of crops, is one that is most marked, and while it is mostly brought about by modern phases of trade and commerce, fairs have tended to increase it. We do not cultivate so many kinds of crops to-day as we did fifty or seventy-five years ago. I have already explained how the societies and their exhibitions tended to eliminate or weed out our less profitable crops, until many have passed so completely out of sight that we now rarely even hear of them here, and the younger generation does not even know their looks.

Without attempting to enumerate more of the uses,—what are the duties of farmers towards societies? The answer is easy—*sustain them and attend them.* If you have anything to say, why say it. If you have anything to show, show it; above all things, don't stay at home and grumble. It is bad enough to go to the meeting or fair and grumble, but it is worse to stay at home, for at the fair the most stubborn and self conceited man may learn something in spite of himself.

There are probably 800 or 1,000 exhibitions devoted entirely or in part to the interests of agriculture, held in the United States every year, and probably five or more millions of people see something of them. It would be passing strange if in all these, voluntary gatherings as they are, and pertaining to such a variety of interests and multitude of details, it would be strange, I say, if something did not sometimes creep in that had better be left out; but how very little there is of this compared with all that is meritorious! Taken all in all, their work and their record has been a glorious one, and they will continue to be a prominent feature in our progressing civilization.

The resolution concerning the offer of the Messrs. Storrs was then taken from the table for discussion. We have only room for the remarks of Prof. Johnson.

Prof. JOHNSON. *Mr. Chairman and Gentlemen:* It appears to me that this offer has in it so much of promise that it would be a sad mistake not to give it a full investigation.

We have long needed such a school as can be easily built up on a foundation like this. I have but a slight personal acquaintance with the Messrs. Storrs, but I know enough of them to have confidence that this offer is made in the best of faith, and from the highest motives, and I believe that a farm school set in successful operation on this land and reasonably fostered by the States, will find in these gentlemen and in the circle of their acquaintance most faithful and most valuable friends, whose personal influence will add largely to its material as well as to its spiritual forces. I am aware that it is honestly believed that Agricultural Schools are a conspicuous failure in New England and westward. It is said that a great deal of money has been squandered in costly buildings, costly farms, costly endowments, ostensibly for the purpose of educating our young men to be better farmers, but which in reality has not yielded and is not likely to yield any adequate return in this direction. There may be some truth in this view; if so, the fact stands as a warning against a repetition of such folly. But no amount of failure makes an argument against honest effort, and no instance of waste can be a valid reason to abstain from wise expenditure. As a rule success is only reached through failure. To establish a Farm School that shall be accounted a success among us will not be altogether an easy matter. If the State should accept this offer, and should appoint a commission of our ablest and wisest men to organize a school, it is hardly to be anticipated that they would be able at once to meet every want and satisfy every expectation.

But with the examples of real success that are to be found on both sides of the Atlantic, there is no reason why a Farm School should not be created in this State, that will soon attract all the pupils it can accommodate, and will reinforce our agriculture with the happiest results.

The founding of one such school, I doubt not, will lead to the establishment of others, and when thereby the farmers of

Connecticut get some actual acquaintance with the true nature and the legitimate results of agricultural education, they will want more of it, and the Professors of Agriculture and of Agricultural Chemistry in the Sheffield Scientific School will be lecturing to hundreds instead of to tens or perhaps to units.

Let me say again that it is a mistake, to suppose that an Agricultural School ought to be self-supporting. Our common schools to day are largely sustained by a grand fund secured to the children of the State, through all time, we trust, by the wise charity of our former legislators. Our Colleges are also great charities made up of the money, and buildings, of many noble givers, some rich, some poor, and of the patient work and spotless lives of many noble teachers. The Scientific School is a grand charity, and costly as its instructions are, the young men who attend it pay for their tuition and their privileges but about 40 per cent. of what it costs to furnish that tuition and those privileges. So it always has been with the higher class of schools, so it must be, no doubt, with all grades of Agricultural Schools.

And is not this the occasion, when we should fully grasp, and familiarize ourselves with the idea of this kind of charity, which is absolutely necessary to perpetuate our free institutions, and to consolidate the material and social basis of our prosperity—our country life.

We have before us the tender of a farm, and of a sum of money sufficient to stock it with animals, implements, and seeds, and put it in working order.

The buildings needful to lodge scholars, the requisite schoolrooms, I understand, are on the ground, and in good condition.

The place for a school is ready and offered free to the State. The State, if it accepts this gift, must create a school upon that farm, must provide teachers who shall teach by precept, and example, good farming, sound science, and honest living. The State must provide the means of instruction. It ought to provide facilities for teaching thoroughly what is most essential for a good farmer in Connecticut to know. It ought to have able teachers, so well paid that they can devote themselves to their work, and give it the benefit of experience and ripeness. This equipment would require an annual outlay of some thousands of dollars, and if the State will accept the gift with the understanding that it is a foundation and cornerstone, which is to be supported and built upon from generation to generation, there will grow up in Mansfield a noble monument to the Founder and to the Builders, whose fame shall be fairer than the lovely landscape that surrounds it, and whose praise shall be heard in hundreds of prosperous and happy homesteads, through all the years that are to come.

At the close of the discussion, the resolution was adopted as follows:

Resolved: "That the Chairman of this Convention appoint a committee of three, to examine this proposition, and report to the next General Assembly."

AFTERNOON SESSION.

The Convention re-assembled at two o'clock, vice-president HYDE in the chair.

The CHAIRMAN. Gentlemen, the chair has had under consideration the appointment of the committee called for by the resolution adopted at the close of the morning session. It is a delicate duty to discharge. It is a question, whether it should be composed of agriculturists purely, whether the scientific department should be represented, or the board of agriculture, or whether it should be constituted of persons outside of the board. The chair has decided that perhaps it would be better that all these interests should be represented, and has appointed the committee as follows: Prof. Brewer, of the Sheffield Scientific School, J. B. Olcott, as a representative of the Press, which is a potent power, and Dr. George Austin Bowen, representing practical progressive agriculture.

It is my pleasure now, to introduce to you Mr. Hubbard.

SELF-EDUCATION A NECESSITY FOR THE FARMER.

BY J. M. HUBBARD.

It is not an uncommon form of speech which describes a person, or a class of persons, as educated, and discriminates other persons or classes as uneducated. Sometimes by a form more accurate: as highly educated and slightly educated, thus recognizing the fact that education of some kind and to some extent is the possession of all; and that the differences between men are of quality and degree, rather than that one is possessed of something of which the other is destitute.

Now I should like to inquire, at the outset of what I have to say, how much a man should know in order to be classed as educated, or, if you please, well educated or highly educated?

I do not suppose that any two persons would have exactly the same standard of judgment in such a matter. And indeed it does not seem possible to have any absolute standard. To judge whether one's education is high or low, adequate or inadequate, we must first know what he is to do with it.

Education is not an end; it is a means to an end. Especially is this true of technical education. One wants all he can use. Less than that is manifestly an imperfection. More than that would seem to be superfluous. Now no education can include more than a fraction of the sum of human knowledge, and no possible training can qualify one to work in but few of the many avenues of mental effort which open before him. The boundaries of knowledge are so wide, its reaches are so immeasurable, that the practical problem presented to every one who would possess himself thereof, for useful purposes, is one of selection. What portion of this immense field can I most profitably cultivate? What are the things that it is essential for me to know? that I cannot afford not to know? and what are those of which I can afford to remain ignorant?

These are questions of vital importance to every one. Unless they are in the main rightly answered, the record of life must be largely one of misdirected energy and consequent failure.

Of the conditions that go to determine in any case the direction that education shall take, one's choice of occupation is an important one. To me it seems the most important, assuming, as I do, that in the choice one's tastes and aptitudes have not been violated. In general, the man who would accomplish any worthy and important work in life must do it in the line of his vocation. Unless he can win a reasonable success here, he cannot hope to accomplish much elsewhere. What, then, ought the farmer to know in order to fit him for the successful practice of his profession?

The list of things which it would be desirable to know is very large. It has sometimes seemed to me as an objection to the present organization of agricultural industry that it required one man to know and to do so many things. Knowledge of many kinds is apt to be superficial. Skill in many different directions forbids high attainment in either. The old proverb about the worthlessness of the "jack-at-all trades" is founded in reason and justified by experience. And so I think it well for the farmer seriously to consider what branches of knowledge he can dispense with, and what forms of skill he can do without. He cannot have, no one can have, everything that seems desirable. He should select that which is most important, and this implies the rejection of that which is of less importance.

You will understand that this recommendation does not look to the reduction in amount of any one's knowledge and skill, but to its concentration, giving to one's acquirements the qualities of depth and thoroughness in preference to those of extent and variety.

I am willing anyone should know as many things as he can know thoroughly, and do as many things as he can do well. Let us see, then, if we can outline very briefly the field of knowledge which the farmer should occupy, and find out what are its limits and what its extent.

He ought certainly to understand farm work, so as to know how it should be done, and when it is done well. And this, I beg you to observe, is not the slight and trifling accomplishment which may appear to you at first thought. There are many kinds of work to be done upon the farm, and the conditions of work well done in all branches are not so simple and easy of acquirement as one may at first think. The labor of preparing, of seeding, of cultivating, of harvesting, of curing, of storing, of fencing, of building, and of repairing in all their subdivisions and details, must be done in the right manner and at the right time if the business of the farm is to be successful. The farmer must be master of it all, not necessarily in the sense of being able to do it all himself, but in the sense of knowing how and when it should be done, and so being able to direct others in the performance of it.

The farmer needs skill in the administration of labor. He doesn't usually control it in large quantities, but he sometimes has to work out complex problems in this line. For instance: Two men and a boy on a farm of one hundred acres—corn, wheat, rye, oats, potatoes, turnips, and tobacco to be grown—hay to be made—horses, oxen, cows, sheep, and poultry to be cared for—orchard and garden to be attended to—fences and buildings to be kept in repair, and the best practicable results to be attained, with the force at command. I tell you, the building of a railroad, so far as the administration of labor is concerned, is a simple problem compared with this. Want of skill here is doubtless the cause of many failures in farming. I think this knowledge clearly belongs in the list which the farmer cannot afford to do without.

Some knowledge of business and some skill in trading are excellent qualifications for the farmer to acquire. He is obliged to buy and sell as well as to produce. He ought to be able to sell at a profit what he produces, and use to advantage what he buys. Turn the statement about and it is equally true. He ought to be able to produce what he can sell at a profit, and buy what he can use to advantage. If he can do this as a general rule, he has one important qualification for his business. It is so important that he can hardly afford to be without it.

It seems to me desirable, at least, that the farmer should have some knowledge of the science of engineering. Perhaps a well trained eye for lines, distances and levels is all that is important, but I think this can best be attained by a study of the science that makes use of these things. In the location and construction of buildings and fences, the layout of drains and water-courses, the arrangements of fields and even the culture of crops, a quick and accurate preception in the matter mentioned would save many a costly blunder. The farmer needs some knowledge of the natural sciences. Geology, chemistry, and botany are intimately related to his work. Geology might be defined as what is known about the soil, and if anybody ought to know that, it is the man who works upon it and wins from it his daily bread. In like manner, botany is whatever is known concerning plants. To whom is this knowledge more important than to him whose chief business it is to discriminate among the many varieties which grow upon his fields, cherishing some with all favoring conditions, and waging against others the fiercest warfare, exterminating where possible and repressing to the last degree where extermination is impossible, that vast army of evil growths of which the "thorns and thistles" of Genesis stand as representatives? It is scarcely conceivable but that knowledge concerning plants would be of great service to one who has so much to do with them.

Chemistry has come into agriculture largely of late years, and it can hardly be necessary for me to say a word to convince this audience of its importance to the farmer. Chemical forces are constantly working for him or against him. Chemical transformations are going on under his hand and he is always either hindering or helping. How shall he be sure that his interference is wise? I know of no other way than for him, so far as he may, to understand the forces with which he has to deal; to know the nature of the substances which he handles, and the laws which govern their relation to each other. And this is chemistry.

I want to mention one other branch of natural science, concerning which I think the farmer ought to know as much as he may. The science of life,—whatever is known concerning vital force, that most wonderful, most powerful, most mysterious force of the universe. Did it ever occur to you that no one handles this mystery so familiarly as does the farmer? He controls its beginnings, he regulates its action, and at his own discretion he wields the shears of Fate and cuts short its thread. Of this and also of the chemical forces it may be said that they will do their work in spite of many hindrances and unfavorable conditions, but what sort of a workman is that who expects success in spite of himself instead of through his intelligence and wisely-directed efforts? In the farmer's case the powers of nature may go ahead even if they have to drive over him, but he ought to know enough at least to get out of the way. I am afraid that there are farmers who stand ignorantly in the way, an obstruction to the willing and kindly forces of nature that are working in their behalf. They ought to know better than to do that. The farmer needs to have his reasoning powers well trained. This isn't so much a matter of knowledge as of ability to use it.

Knowledge is however of little value to him who cannot use it skillfully and effectively. The farmer should be logical. The connection between cause and effect in his business is sometimes obscure and yet it is important to trace it correctly. It is at least important not to be led into error and accept as consequent what is only coincident. It is important to distinguish between succession in time and the succession of cause and effect. Now the farmer who refuses to believe that chemical fertilizers have any value because he once tried phosphate on his corn and failed, or who never plants his beans in the "old of the moon" because in one instance when he did so "they run to vines," shows, I think, a slight deficiency in his logic. He needs (whatever may be true of you and me), more education. If he doesn't need to know any more he needs ability to make a better use of what he does know.

I can hardly leave this branch of my subject without noting the fact that the farmer is a citizen as well as an artizan. All of his powers of body or mind can fairly be engrossed by his business. As a citizen he must have part in the government of town, State and Nation. He must be ready to do his share of the work of organized society. A share of the burden of maintaining the institutions of education and morality, and the varied forms of associated effort by means of which men work for the good of some larger fraction of society than the individual or family, falls rightly upon him and he may not shirk it without blame. One cannot rightly discharge the obligation which civilized man owes to organized society without other than business knowledge, knowledge that he needs in common with the mechanic, the trader, and the professional man. He must not be found wanting here.

I wish in passing to recognize the fact that a good degree of success in agricultural pursuits has been gained by men whose knowledge of science was very limited. It may seem at first that this fact is inconsistent with the position taken, that the farmer needs scientific knowledge. But it will be found I think in every such case, that the successful individual had compensations for his deficiency in scientific knowledge in his capacity for administering labor and transacting business. He could buy and sell shrewdly and boss a gang of men effectively, and I frankly admit that there is more money in these than in scientific acquisitions. But for you, my friend, and I, who more often than otherwise get the worst of it in our bargains, and who cannot get more than a fair day's work out of a man anyway, the compensations must be sought somewhere else in the list of desirable things. One person cannot have them all in their highest development, but they are all valuable and important. We cannot afford to leave out one of them. Indeed, the list might be made much larger.

It has not been my purpose to name everything which it is desirable for the farmer to know, or to give anything more than brief comment to what I have named. My talk has mainly to do with the second division of the general subject offered for the consideration of this convention. When? what? has been answered; we ask, how? Having, so far as we may, settled the question what knowledge we need to possess and what skill to use, the next question is how to acquire them. My part of this discussion belongs to the "how" division. In the search for sources of knowledge we naturally turn first of all to the machinery and means of educatiod already provided. Can the farmer depend upon schools of any sort for the knowledge he needs? Setting aside for the present the case of the adult farmer, can we depend upon schools of any kind to train the young farmers of the country for their work? Evidently the common schools of the country cannot do it. They are fully occupied in the task of giving a primary education to children whose vocation in life is yet undetermined. What they have to do is to lay the foundation, simple but sound, upon which any superstructure of education may be built. They cannot give technical training, agricultural or otherwise, for their work antedates it in point of time, precedes it in order of development, and, without it, fills to the brim the measure of their capacity. Indeed, they are often criticised even now for attempting to teach too many branches of knowledge, and for that reason failing to teach any as thoroughly as they ought. Evidently they cannot take up anything in addition to what they now carry. In so far as the high school and college teach the natural sciences, they supply knowledge which is useful to the farmer. But this is not their chief aim or object. They are for professional men or men of wealth and leisure.

Their whole drift and tendency is away from the farm. Then the knowledge and training which they furnish, though unquestionably of great value, demand of the student more of time and money than the great body of farmers can afford to give. A college education is at once unsuited to the farmer's needs, and a luxury which he cannot afford.

But we have agricultural colleges, and they certainly, if there is anything in a name, ought to be just the thing we need. We have them, it is true, but, somehow, as a matter of fact, they don't educate farmers. So far as I know, they are good schools. They graduate engineers, teachers, business men, professional men, and now and then a farmer. They are by no means failures. Probably they are worth all they cost, as schools, and besides the service which they do render to the community at large by instruction, there is another service which they may, and I think will render, of immense value to agriculture, by investigation. A thousand problems of importance to agriculture press one upon the other's heels for solution, and the skill of the ordinary farmer and the appliances of the ordinary farm are not sufficient for the task. Let agricultural colleges take up the work of investigation, of coöperating with the farmers and helping them to investigate, doing for them such portions of the work as the farmers cannot do, and they may instruct and graduate a class of such magnitude as no other institutions of learning ever dreamed of.

But this is something of a digression; what we are after now is some agency that will fit a young man for the profession of agriculture. We do not find it even in the agricultural college. Before we give up the search, however, let us look a little more closely into this matter of education. It might perhaps have been done more properly at the outset, but it isn't too late now. What is the work which a good school does for a good student? I offer this as an answer: It stores his memory with the knowledge he needs to use and trains his mental powers to a high degree of efficiency in the use of it. If it does this it does a great work. I do not see how it can well do more. But the memory is not simply a fact-tight receptacle into which knowledge may be poured until it is full and dipped or drawn out as it is needed. In order to hold knowledge in a way to use it when wanted, it must be acquired in a different way from this. No passive reception of facts gives the needed command of them. They must be conquered by effort on the part of the student. They must be mastered by toil. Familiarity with them must be attained by repeated and patient examination on all sides and from every point of view. And if it be true that effort on the part of the student is a necessity, in the fact-acquiring department of education, it is far more true of that other department which has to do with mental training. The very essence of mental training is work on the part of the student, and the advantage of a good school is that in it this work is guided and regulated by experienced teachers. It is done, too, under favoring circumstances. It is the business of the time and place, and everything is arranged for it. There is a stimulus to work from the teacher's enthusiasm and the rivalry of comrades.

The public opinion of a good school will hardly let a scholar be idle.

Now these conditions are undoubtedly very helpful, and yet these are the very ones which, so far as I can see, the farmer in qualifying himself for his life-work must do without. If they are absolutely essential to an education his case, so far as I can see, is hopeless.

While he who fits for his profession in school gives to the task ample periods of time, and surrounds himself with all favoring conditions, the farmer must use odds and ends of time snatched often from pressing labors, and hold himself to the task in spite of many distractions. So when I say, as I do, that the farmer must be self-educated, I mean something different from what the same term would mean as applied to a student. He must gain his information in the midst of his work. He must fit himself for his vocation while he is gaining a livelihood by it. Himself must fill the offices of both teacher and scholar. The stimulus which holds him to his work must come from within instead of without. His own enthusiasm must burn with steady light and heat.

There is nothing impossible about all this. Instances are on record, not a few, of men who without the aid of schools or teachers have raised themselves to the highest ranks of their chosen vocation. Members of the New Britain Farmers' Club can hardly fail to call to mind in this connection, that magnificent example of a self-educated man, who for many years served as their secretary. The fame of Elihu Burritt's learning and wisdom was as wide almost as the civilized world, and it was every particle of it honestly earned. But the common farmer will be likely to feel that such examples are not for him to follow. He will be apt to think that something exceptional in the circumstances of such self-educated men separated their cases from the common lot, and made possible to them what is denied to all others. Something exceptional there very likely is, in the cases of those who have become conspicuous, but it is not necessary to lead a life that attracts public attention largely, in order to be successful. Notoriety, in the nature of things, pertains to but few, but success in the broadest and best sense of the term may be the lot of many. The work one is called to do may be public or private, but if it be a useful work (and I take it no man is ever called to do any other), and if it be mastered and done thoroughly, it makes that life successful, and almost certainly brings an adequate remuneration.

Fitness for his work is what I think every man should desire and seek for, until he finds it. It will not come of itself; it must be sought and sought diligently, but it may be found, and it is well worth the cost of finding. I speak more particularly to young farmers, of whom thousands in this broad land of ours are yearly leaving behind them the ordinary appliances of education, and to whom the further knowledge so important for them, must come, if it come at all, through their own efforts. It is natural that they should think that study as a regular and continuous matter is over for them when they take up the burden of regular labor, and the responsibility of farm management. It is a natural but mistaken thought. Less time than formerly must be devoted to it, but study should be arranged and provided for as an essential part of the programme, instead of being left to chance moments and impulses. Into the scheme of life, which every young farmer outlines with more or less distinctness, should come means and opportunities for study. There will be hindrances enough, and obstacles enough for our most vigorous efforts to overcome at best.

The paralysis of a vague and unformed purpose can hardly fail to be fatal to any worthy progress in self-education. Let the young farmers, and farmers not so young may do the same thing—let them all look this matter squarely in the face. Knowledge, broad, varied, deep, and thoroughly possessed, is to them all of the highest importance. They cannot look to any institution or individual to teach them. They cannot trust to guess-work. They cannot jump at conclusions. They must deal with verities and be in possession of certainties. And this search to find out and struggle to acquire will never come to an end. The farmer never reaches the point where he needs nothing more in the way of knowledge. He never earns the right to say, I have all the skill I need, I will not strive for more. He may not stand still because his business will not.

Farming is not a matter of rule or precedent, it is the adaptation of nature's infinite variety and affluence of production to the ever-changing requirements of human desire. To make himself equal to the demands upon him, to lift himself and his profession to be the peer of any, and to command the respect of all, is certainly no trivial or easy task. It is of sufficient importance to find a place in the farmer's plan. He must treat it as he would any other important part of his task. If the year or series of years for which he plans, includes the erection of buildings, the improvement of a field, or the culture of an important crop, he assigns to it a portion of his time, provides for it a portion of his means, and bestows upon it a due proportion of his thought. In these practical ways he recognizes its importance, and unless he did so, his task would never be accomplished. Just so if he would build and fill the storehouse of memory, make more productive the field of his mind, and clothe himself with skill as with a garment, he must plan for it, spend for it, labor for it. A good education is one of the things that can be secured only by intelligent effort; no one can ever blunder into it.

For him who is ready and willing to do all this, what shall be the next step, and what the successive steps that he needs to take? Without insisting upon the order of the steps as important, I would say next, Let him read. The farmer should be a reading man, and his reading should include something besides the partisan newspaper, or the continued story papers.

There is in existence a literature of his profession with which it is important that he should become acquainted. Books are the storehouses wherein are preserved for our use the valuable products of past study and research. As early as possible in his career, the young farmer should avail himself of the knowledge which others have gathered for him. He need not fear that there will be nothing left for him to find out. Plenty of uncertainties and mysteries remain, and he will be far better equipped for their solution after learning what he can from the patient and successful workers and thinkers who have gone before him. Next to books come agricultural periodicals. No farmer should be without one, and usually more than one might be read with profit. Right here let me say with regard to periodical literature in general, that I know of nothing on earth comparable to it for cheapness. Take any well-conducted newspaper or magazine, and consider for a moment, either what has been expended in its preparation, or the value to you of what it brings, and the price at which it is furnished seems amazingly small. If one's capacity for appropriating wealth of this kind were not limited as it is, anybody could get rich fast by reading newspapers, and as it is, the man who limits himself to anything less than all that he has time to read and digest commits a great blunder.

The art of reading ought to be cultivated to a high state of efficiency, and this can only be done by large and constant practice. How rapidly a trained reader goes through a book or paper, and how thoroughly he possesses himself of its contents. A glance of the eye tells him so well the general contents of page or column that if there be in it anything worthy of close attention he can bestow it, or if not, pass on without hesitation or delay to other matters. The faculty is a wonderful one and he who has acquired it would hardly part with it for the wealth of Vanderbilt. This faculty the farmer as much as any one needs to possess, and it is easily within his power to acquire it. And then he needs to use it. He needs first to master the literature of his profession, and then he needs to keep abreast of the front rank of the army of occupation as it marches to possess new territory. Only a high degree of skill, a well trained art, a thoroughly developed faculty of reading will enable him to do this.

Next after reading, I name observation as a means of self education. The use of the senses to acquire information concerning everything of interest or value that comes within their range is a matter of the first importance. This is the way in which all knowledge at first came: Somebody saw, somebody heard, and continually he that hath eyes to see and ears to hear, may come through the use of these sensitive organs and an active brain behind them, to the knowledge of truth that men with dormant senses and dulled minds pass unconsciously. We cannot afford to forego these original methods of acquiring knowledge. We can, it is true, use much of the knowledge that others have conquered for us, but there are some things which we must find out for ourselves. Then it would be no more than a fair compensation for our use of others' discoveries, if we were to contribute something of our own, provided we have anything to contribute, to the common stock of the world's knowledge.

We are, it is true, the rightful heirs of an immense accumulation of wealth in the observations of others, but we cannot live wholly upon it. Our own observations are necessary to test the value of the knowledge we have gained, to add to it and to show us how to apply it to our own cases.

We need keen and well trained perceptions to use in the application of well-known general principles. The engineer who takes the lightning express up and down the steep grades and around the sharp curves may be perfectly familiar with the construction of locomotives, the expansive power of steam, the laws of force and resistance in their every application, the cumulative power of momentum, the steady resistance of friction and the alternately accelerating and retarding action of gravity, but all this knowledge does not exempt him from the necessity of alert senses and wary outlook to rightly use the tremendous forces within his control. In something the same way must the engineer of a farm be alert and watchful. He too has his grades, and some of them are pretty steep. All the force at his command will hardly draw his train of cares and interests up the long ascent, or hold events from sometimes rushing to destruction on the down grade, while there are curves in his track so sharp that his out-look ahead is cut very short indeed. Quick to see, quick to comprehend and prompt to act must be the farm engineer who brings his train through safely every time.

I think it an excellent plan to stimulate the powers of observation by travel so far as one has means and opportunity. The contact with fresh minds and the sight of new and varied scenes which travel gives, have a real power to enlarge and stimulate one's perceptions. I doubt if any one ever went abroad and made good use of his opportunities who didn't on his return see more in the old familiar landscapes of home than he ever would or could have seen if he had always remained there; for seeing is not a mere mechanical operation. The picture may be before the eye, but unless the mind makes use of the eye as an instrument and gets the key to the right combination of outline and color and light and shadow, it is like the puzzle pictures that are printed with the real meaning hidden or obscurely revealed while a misleading one lies upon the surface. I do not suppose that two persons ever looked at the same view and saw in it just the same, either in amount or kind. Now nature has an exhibition of wonderful interest and variety constantly before our eyes. Her language is always that of invitation, "See what I have made," she says; and after, "See how I did it." While I think highly of travel, and would recommend it wherever practical, it is because of its influence upon the observer. It is not necessary even to leave our work to go and see what nature has to show, for she surrounds us with it all the time. Our needs and our only imperative needs are ears to hear her generous invitations, hearts to respond, eyes to see, and minds to comprehend and appreciate her wonderful exhibit.

After observation comes investigation. Indeed it is but observation pushed into new fields. It is observation under fixed conditions and with an aim at definite results. Instead of simply responding to nature's invitation to come and see her working and her work, the investigator takes the initiative and demands to know more than she volunteers to tell. What would you do under such and such conditions? he asks. How do you produce these, and these results? he demands, and nature, recognizing the right of him who is at once of her and above her, responds obediently. Under the questioning of scientific investigation she has already disclosed most wonderful mysteries, and yielded up the control of unmeasured powers. What limit, if any, can be set to these disclosures doth not yet appear. It may not indeed be the lot of the ordinary farmer to uncover great mysteries or acquire control of new powers, but each farmer is put in possession of a little section of nature, and he needs at least to know his own farm thoroughly. Keen observation will tell him much, but he can hardly find out all he ought to know without investigation.

Right here, just where he needs it, he can derive much help from agricultural colleges, experiment stations, or any institution that is carrying on the work of scientific research upon lines that touch his business. They cannot do his work for him but they can and will set him up in business with a capital of assured facts and principles from which he can work out safe and valuable applications for his own case. The experiments in the application of chemical fertilizers to different crops and soils made under the direction of Prof. Atwater within the past few years have had results of great practical utility, whatever may be thought of their scientific value, and they furnish a fine illustration of what the farmer may do in the way of investigation.

When you have gathered together your materials go forward and build your house. After supplying yourself with tools take them in hand and use them. After reading and observation and investigation, which are means and methods of acquisition, comes thinking, which is conversion, adaptation, and use. Not only thinking is required if worthy use is to be made of material acquired, but right thinking, thinking that goes straight to the mark, that hews to the line no matter where the chips fly, and works every piece to its appointed shape and fits it to its appointed place. There is as much difference in what passes under the name of thinking as between the first bungling efforts of the apprentice, which waste strength and accomplish little or nothing, and the strokes of the trained workman who makes every outlay of strength tell with all its force in the right use of his material. The slipshod thinking which recognizes the influence of but one of a group or line of causes in producing a given effect, which cannot or will not distinguish between the relation of cause and effect and simple coincidence or succession in point of time will never answer our purpose. Of all thinkers the one who has to do with the problems of agricultural science and practice can least afford to do this kind of work. Of the line of causes upon which the results which he observes depend many are hidden or obscure. The coincidences which might easily be mistaken for causes are many and varied. He who has such a task before him must not be satisfied with 'prentice work. If not already accomplished in the art of thinking he must at least have a worthy ideal of it in mind and be working steadily toward it. As a help in this particular as well as an important step forward in the general work of self-education, I say, when the thought has taken form and won approval, give it expression.

I suggest three forms of expression, the first of which is spoken language, the second written language and the third is action. Without expression in some form, thought, however valuable, can never be realized upon. Its impression is apt to be slight and transient. It vanishes like the fog instead of descending like the rain to make fruitful the earth. In another particular the fog may serve as an emblem of unexpressed thought, and that is in dimness of outlines and tenuity of substance. Nothing so tends to consolidate and define thought as careful and accurate expression. Expression not only helps to class and define ideas, but it furnishes a valuable test of their validity and importance. Expression separates an idea from its author, and enables him to take an independent view of it. He can then go entirely around it and look at it from all sides, which is a thing he couldn't well do before. He may even put himself in a position of antagonism to it and see if it has strength to stand against him. We say sometimes of a principle or a conclusion, "to state it is to prove it." It may be equally true of a plausible idea or impression that to state it clearly and fairly would be to disprove it. Yet the one would not be proved or the other disproved without statement.

I named first of the forms of expression oral language or speech. It is the commonest form, the easiest, the most convenient. In a master's hand, it is an engine of tremendous power. And yet I think it, of all, most liable to unprofitable use. It is so easy, so available, so convenient, that there is danger of its being used without thought, rather than to express thought. It does not seem necessary to recommend its use, and it would certainly be wasted breath to advise any one to refrain from using it. I would advocate its careful use. If it is to be an educational force, it must be used with skill and care. It must be used accurately. Thus used it reacts upon thought, making that also more accurate and clear, more active and forcible. Next comes written language, and among educational influences, I value very highly the practice of writing. The farmer who would thoroughly educate himself, cannot afford to neglect it. It isn't easy, at least not for every one, and I think not for most persons; but that is also true of many other valuable and instructive exercises.

Indeed, I think it almost a rule that those things which are valuable are not easy of acquirement, and those things which are easy are not valuable.

But he who would educate himself must not look for easy tasks. I do not invite him to any such entertainment as that. Reading and talking may be thought easy, but the kind of reading and talking which train and develop a man, and furnish him abundantly with all useful knowledge and power, are not easy to learn, even if they are, when learned, easy to practice. Writing is more rarely easy, even after long practice, but it is mental discipline of a most effective kind. It so permanent and unchangeable in its nature, the requirement is so imperative that expression shall be at once full, clear, and accurate, that one's best powers are called into action, and compelled to work hard to accomplish the task. One may jump at a conclusion, and feel no doubt in his own mind as to the logic which lands him there; he may, in conversation with his neighbor, state his position and argue volubly, and with apparent success in its support; but let him sit down and write it out, state his point clearly, and support it with logic that cannot be shaken, founded upon premises that are undoubted; let him construct a statement and an argument that will stand alone. If it doesn't seem different to him before he gets through with his task, it is strong testimony to the soundness of his ideas and the value of his conclusions. If additional testimony upon these points is desired (and no one should be content with less than the most and best), let the writer publish his statement and argument, and challenge the critics to do their worst. And right here, I wish to congratulate the farmers of Connecticut upon the possession of a vehicle of communication with each other, and an organ, if I may so call it, for the presentation of any worthy ideas or weighty arguments concerning matters of agricultural interest, which meets them at this point with just the opportunity they need. The *Connecticut Farmer* may be far from perfection, according to some standards, but in this respect, as a paper which the farmer can use to bring himself into communication with other farmers—through which he can learn from them, can learn from himself by means of the effort to contribute something to the fund of information, experience and argument which it weekly sets before its readers, I do not know of its equal anywhere. I counsel the farmers of Connecticut, especially the young farmers, to make use of it.

One other form of expression remains, and that is the most important of all. We say of a picture or a statue, "it is the expression of the artist's thought." So, too, a noble edifice is called an expression of the thought of the architect, and a fine park or garden likewise expresses the thought of the gardener. Run now, if you please, the dividing line through all the works of man, separating those which should be the expression of thought from those which need not be, and on which side of the line would you find the farmer's work? The lay-out of a farm, for instance—is it work to be done at random, or automatically, or does it require to be thought out beforehand? The improvement of a field—is any thought required for it? or may one go some morning with tool in hand and say, "I believe I'll go and improve that field, it needs it?" It will probably need it for a long time if approached in that spirit.

The culture of a crop even, any crop, is not a matter so simple that he who understands it can be excused from thought in connection therewith. In general, the tasks which the farmer finds before him are not simple. His results depend upon many conditions, some of which are controllable, and some are not. Thoughtlessness should never be characteristic of his work; it should represent his best thought, his selected and tested thought.

Perhaps I may as well say here as anywhere, that not every thought is worthy of expression in any form. There are many thoughts, even of wise people, that should be denied even the utterance of speech. Expression demands the attention of others, a demand we have no right to make unless we have something worthy of their attention. A certain measure of responsibility attaches to every form of expression. One's thought is thus sent forth as his representative, and all to whom it comes are called upon to receive it with the respect and faith due its author. A simple utterance of one's thought is a profession of faith in it. A careful and public written statement of it adds weight and gravity to this profession.

But when one puts his thought into action, he gives the highest possible testimony of his faith in its soundness and value. People no longer doubt his sincerity, however much they may his wisdom. And no one ought to bear this kind of testimony in favor of ideas which have not been subjected to careful scrutiny in the light of the best information he can command. It is too expensive to throw away. One's stock of it is limited, and upon its use, right and profitable, or mistaken and wasteful, turns the question of the success or failure of his life. He may not waste it; he may not expend it heedlessly, for it is the final outcome of life and cannot be wrought over into other forms, or exchanged for anything else.

Now I think I have pursued this line of suggestion far enough, and that it is full time for me to turn and meet the obvious criticism that the scheme already laid out is too large, and lays upon the farmer a burden which, in addition to his necessary labors, is too heavy for him to carry. I admit that the scheme comprehends a good many things, and no inconsiderable quantity of each. I intended that it should include much. I meant that if it erred at all in this particular, it should err in that direction, for if one aims only at little, he will surely accomplish and acquire but little. Now we all desire, and ought to desire, great things, great possessions, great powers, great attainments, and while I agree that it is not wise to waste our strength in a struggle after what is manifestly beyond our reach, we ought not, on the other hand, to limit our efforts to anything less than the largest measure of good we are able to attain and acquire.

In favor of the reasonableness and practicability of the outline that I have presented, I have time to offer only a few brief suggestions. I say then, first, that much of the work can be done by using the broken fragments and brief periods of time which cannot be used in the labors of the farm, and would be wasted if not used in some such way. The farmer generally has his evenings; he has rainy days, and he has those little fractions of time which occur before and after meals, and when different jobs of work fail to connect, and, like the railway traveler, he has to wait for a longer or shorter time at the junction. The farmer ought to have his evenings largely for reading. I protest against the use of evenings for work. If a farmer cannot contrive to get his work done in the ordinary working time of the day, he had better quit and go at something else. And I revolt against that idea of farm management which is so careful to have work laid up and waiting for the possible rainy day. I believe in industry, but I don't believe in drudgery. No workman, whatever his occupation, ought to do three hundred and thirteen days' work in a year. Besides the Sabbath rest, he ought to have, and he ought to take, other days for the recreation that comes from change of scene, change of occupation, and change of thought.

And this brings me to my second suggestion, which is, that very much of the labor required for and involved in a scheme of self-education like this which I have outlined furnishes recreation precisely suited to the needs of the farmer. Suppose he undertakes an experiment to clear up some obscure point in his practical work, and devotes to its details time when he might have gone fishing, or to the circus, or lounged and listened to or told stories at the village store, from which exercise would he be most likely to come back to his work refreshed and invigorated?

Suppose he takes the recreation to which every faithful worker is entitled, and which he should take in some form, in the form of experimental investigation upon his own farm, and excursions, long or short, as he can afford, but undertaken with the specific object of gathering useful knowledge by means of observation. I believe that such a course would accomplish all the beneficent uses of recreation, and that before it many of the difficulties of self-education would vanish away.

One other suggestion which I have to offer is this—that the process of thinking may often go on without interfering at all with the labor of the hands. Very much of the farmer's work trained hands will perform automatically, while the brain is employed upon something entirely distinct, and the freely-traveling thought is far away. I know that this is not true of all the farmer's work—some of it requires close attention, and will not admit of vagrant thought, for thoughts which wander when they ought not are vagrants, while thoughts which travel with due authority and upon useful and appropriate errands, are certainly legitimately employed. What is needed is, first, a high ideal of the object to be attained; second, a clear idea of the means to be used; and then a firm and wise self-command all the way. Not self-restraint merely, for that is but a part of self-control, and an inferior part at that, but self-use—the ability, not merely to say to the impetuous and wayward impulse, "You shall not," but also to order into action the powers which often linger and hesitate. It is he that "ruleth his own spirit" that is great, and when the centurion of Judea would illustrate his power to rule, it was not by examples of negation and denial, but, said he, "I say to one, Go, and he goeth; and to another, Come, and he cometh; and to my servant, Do this, and he doeth it." So ought every man's will to stand among his powers supreme, knowing well the capacity of each, and wisely dividing to each its share of work.

If self-education be sought in this manner, and with this spirit, I am sure it will be found, not necessarily easy, but entirely practicable, and I am sure that no one once fairly embarked on this voyage would ever look back with regret. And it is the retrospect which, after all, gives the truest view of life. Would any one wish to lead a life upon which he could look back only with sorrow and regret? Opportunities missed, means wasted, powers undeveloped, these are not pleasant things to come prominently into the retrospect of life, and they will surely be there unless strenuous and wisely-directed effort shall cast them out.

This, then, is the theme I have striven to present. The farmer a student, a working student, exercising and developing all parts of his complex nature; a studious worker, directing all his labors profitably because he has studied and understands both his business and himself; a life-long student, never ceasing to grow in knowledge and wisdom till life and work are laid aside together.

I do not feel particularly gratified when oily-tongued orators and glib writers think they compliment the farmers by calling them the bone and muscle of the nation's body. I want to see them take up some of the functions of brain and nerve as well. I want to see them sometimes the directing and commanding element, and not always the one that serves and executes.

I want farmers to lead a life which shall be satisfactory, not necessarily because it attains great wealth, or high position, or notoriety in any form, but because in each case it improves the opportunities open to it; develops the powers given it; accomplishes the work set before it, and commands and enjoys a fair compensation for its labors; a life upon which one may look back and quote and apply without sacrilege the words of the great apostle, "I have fought a good fight."

Just before leaving home a friend who was looking over the programme of this convention said to me, "You have a grand subject." She spoke only the truth. The theme is indeed a grand one, but how inadequate to a worthy presentation of it my words have been, none can realize more keenly than myself. I can only hope that they may give a direction and an impulse to the thoughts of those who have so kindly and patiently listened to them, which will help them to think it out more thoroughly and satisfactorily for themselves. Sometimes I think this the best service that writer or speaker can render to those who read or listen. If I have accomplished this, I am content and more than content.

[Mr. J. J. Webb, of Hamden, in the chair.]

The Question-Box opened by the Secretary.

QUESTION. What are the results obtained by those who have practised the system of ensilage, and exhibited the product at this Convention?

Mr. HURD. I opened my silos on Thanksgiving day. The Coe brothers opened theirs not far from the same time. It seems to me rather premature for us to attempt to state results, but, so far, they have been very satisfactory. My cattle are eating the ensilage greedily, and my milk pail is growing fuller. My cream tests were better day before yesterday than they were the day before I began feeding ensilage. The feed, except in substituting ensilage for hay, has been just the same.

Mr. PLATT. I would like to ask Mr. Hurd to state the number of pounds he is feeding to a cow per day, and whether he is feeding any other forage crop, corn stalks, hay, or any of those crops that are usually put into the barn ?

Mr. HURD. I can only answer part of that question. I began the day after Thanksgiving feeding one ration of ensilage a day, taking it out of the silo fresh and giving it to my stock. My cows are now having nothing but ensilage, except grain. How much I am feeding, I cannot give you in pounds. One cow eats about two bushels and a half a day.

Mr. PLATT. I am deeply interested in this system, and would like to see it advanced, for I am full of it, and have been ever since I investigated it, at Dr. Bailey's in Billerica, last spring. I can see a profit in it: and when I state to you that I am keeping cows that did not have any rowen feed this fall, (they came into the barn in as good condition as they ever did, or as my neighbors' cows did that had rowen feed),—I am keeping those cows on ensilage, and that is the only feed they have had since they came from pasture except corn, at an expense of about four cents a day for ensilage and a trifle over six cents per day for grain, and they are gaining in appearance, and I judge in health, and the flow of milk is increasing: and also the number of pounds of butter, notwithstanding the time is going on from the time when they commenced producing last spring. I have been feeding ensilage two months, and I have found a gradual increase as I have increased the feed. My experience has been, that it takes so much to sustain a cow: a trifle added produces a margin, and a trifle more a good margin. By computing my measurements that I made yesterday morning before leaving home, I have got these figures: Each cow has eaten about eighty pounds a day. I have two large-sized cows that eat a trifle more, but I do not see any gain by feeding an extra peck of feed; I think it would tend to bloat. I was a little astonished when

I figured up this morning, to find that I was keeping my stock so cheaply. I know what it has cost to put that ensilage into the silo, and I know I have got about as fine a thing as I desire. I believe it is a system that farmers have got to adopt. I do not see how my neighbors are going to compete with me unless they do.

Mr. AUGUR. As I was coming to this meeting, I met a gentleman over eighty years old, the father of the Coe brothers, and I enquired of him what they thought of ensilage. The old gentleman got quite enthusiastic, and said, "We have got to build one or two more silos next spring. It is a grand thing. We are feeding our cattle almost exclusively upon it, and they are gaining flesh and doing well." One of his neighbors told me that he took home samples of the ensilage, and offered it to nine cows, and he said that eight out of the nine took hold of it greedily the first time it was offered them; the other rather refused it.

Mr. PLATT. I will state that there were six cows, a yearling, a four-weeks' calf, and a pet kid of the boys, and they all took hold of the ensilage on the first opportunity.

Mr. WHITTAKER. How do you arrive at your conclusion, that your ensilage costs but four cents a day? I think that is an important point.

Mr. PLATT. The cost of putting the ensilage into the silos was forty-two dollars. That is as near as I can get at it. I find that thirty cubic feet will contain one ton, and by figuring upon that basis I find that it has cost me a trifle over a dollar a ton. You can make the calculation yourself, and you will find that if a cow eats eighty pounds a day, the cost does not vary much from four cents a day.

Mr. WHITTAKER. What was the cost of the material that you put in? We have got only the cost of the labor of putting it in. There was some value certainly to the material put in.

Mr. PLATT. I did not mean to give the idea that it cost forty-two dollars to put it in. It included the cost of the labor in the field, and of getting it into the silo, but not the cost of building the silos. I did not include the cost of the silos, any more than I would have included the cost of a barn, and I did not include the cost of the manure I put upon the soil.

Mr. **Whittaker.** How much did you put in?

Mr. **Platt.** Forty tons.

Mr. **Whittaker.** Did you raise forty tons at a dollar a ton?

Mr. **Platt.** That includes raising and putting it in, not the interest on the land, nor the manure. There was a trifle over an acre and a half of land. I dug into the side of a hill and built a concrete wall, and cemented the bottom. I built a wall between the planking and the bank, except at the east end, where the door is. That I planked both sides, and made the wall heavier.

Mr. **Bill.** I take kindly to this ensilage system; but "a burnt child dreads the fire." I have been foremost in many of these projects, and now I am keeping back to get information before I go into another enterprise. I remember a number of years ago, the Government sent me a package of Sorghum seed. It was so represented to me that I went into the business of raising Sorghum, and I came out minus. You can't burn me again in that way. A number of years ago, when Solon Robinson was the agricultural editor of the "N. Y. Tribune," article after article appeared in that paper with regard to cranberry culture, in which it was stated that there was not an acre of marsh ground on the line of Long Island Sound that was not capable of paying a profit of a thousand dollars an acre, more or less. I had considerable of that land, and I made up my mind that I could turn it to good advantage. I went into the cranberry culture, and invested thirty thousand dollars, clean money. I would take thirty thousand cents for that land to-day. I remember a good many such projects that I have been into, and come out every time with a loss.

I have read with a good deal of interest the articles that have appeared in the "*Farmer*" from time to time in relation to the ensilage system, and, as I say, I am in favor of it; and no subject has been started since we came together at the commencement of this Convention that is of so much interest to me as the subject now before the meeting; and if there is any more practical information to be presented before this meeting I shall be glad to hear it, for there is no subject in which farmers are so much interested as they are in this matter of obtaining a supply of cheap fodder for their stock.

The CHAIRMAN. I hope every person who has had any experience in feeding ensilage, or erecting silos, will give it. As Mr. Bill says, "a burnt child dreads the fire." I am a good deal interested in the subject, but I must say I am in doubt. I want to hear all I can for and against it, and I presume there are many others present who are in the same state of mind.

QUESTION. I would like to enquire of Mr. Hurd, if he has discovered any disagreeable flavor in the butter? we all know that ensilage produces milk, but I would like to know whether it is productive of a bad flavor in the butter.

Mr. HURD. I know our last churning was about as good as we get in summer. I cannot detect any flavor that is due to the ensilage; but, at the same time, I have no hesitancy in saying that ensilage fed to stock will impart a peculiar flavor to the butter, just exactly as meal fed to stock will impart a flavor. I do not care what the feed is, it will affect favorably or unfavorably the flavor of your butter. It is too early for me to say what the effect of feeding ensilage is on my butter; but during the last winter a party of gentlemen, some of them gifted with very acute tasting organs, went up to Dr. Bailey's place at Billerica, and tasted the milk, the cream, and the butter, and they made up their minds, with the exception of one gentleman who had a superfine taste, that they could not detect any ensilage flavor at all. Dr. Bailey sent out and got a pitcher of milk from one of his neighbor's cows, that never had had any ensilage in her life, and said to this gentleman, "I wish you would taste of that milk again." He did so, and said, "I believe I can taste it a little mite." That was the 3d of March, and Dr. Bailey opened his silos in December, and his milch cows had had no other forage crop but ensilage, or very little, during that time.

I would like to ask the question, why it is that "the burnt child dreads the fire"? why did it get burned? Because it went about something it did not know any thing about. If we go into any thing with our eyes shut, and "go it blind," we are very apt to get burned, and I think we ought to. This question of ensilage is attracting a good deal of attention; I am glad it is; but still, I should be sorry to see any farmer in Connecticut laying the foundation for a silo, until he has thoroughly investigated the matter for himself.

QUESTION. Are ripe apples injurious to milch cows?

Mr. GOLD. Fed in moderate quantities, I say no, but beneficial. If fed in large quantities, or if a cow is allowed to go and help herself, I say injurious, even to being fatal.

QUESTION. Can farmers afford to feed hay at present prices? In other words, is it not better to sell hay and buy meal?

Mr. ———. Have you ever known a farmer sell hay and buy meal? I have known a good many of them sell hay, but somehow or other they stopped at the bank and left the money there.

QUESTION. Will Mr. Woodward tell us what he knows of the use of Paris green for killing coddling moths?

Mr. WOODWARD. We have tried up in Western New York almost every remedy for the coddling moths, and found them ineffectual. A friend of mine, in 1876, had what he called canker worms in his orchard, and wanted to know what he should do for them. I told him to get a force pump and syringe his trees with Paris green. He did so, and later in the season he told me the Paris green had not only killed the canker worm, but the coddling moth. I said, "that is something new; I never heard of that before." I went with him to the orchard, and you could tell where the Paris green had been applied just as easily as you could see the row of trees. There were twenty times as many coddling moths in the apples on one side of that line as there were on the other. Since then, I have recommended it to many of my friends. I have tried it myself, and there is no more doubt of Paris green being an entire preventive and specific for the coddling moth than there is that it is an entire preventive and specific, if properly applied, for the Colorado beetle. I made a statement similar to this in Michigan last February. I attended a meeting out there this fall, and Prof. Beal made the statement publicly that, rather doubting the efficacy of Paris green, he had taken particular pains this summer to try the experiment on the farm of the Agricultural College, in numerous instances, and he was just as certain as he could be that it was an entire specific for the coddling moth. A gentleman in Detroit told me that he had hardly ever had a perfect apple; he tried Paris green on a single tree, and the result was that that tree had to be propped up, while his others were as bad as ever.

Our method of application is this; when the apples are about as large as cherries, when they are still standing up, we apply the Paris green with a force pump, using a fine rose, and spray the trees thoroughly. Some object to it; they say it is poisonous, and so it is, very poisonous; but I have never yet seen any person injured by eating apples where the coddling moths had been killed by Paris green. Prof. Beal told me privately that he had, on three different occasions, gathered apples, and examined the blossoms and the calyx, under the microscope, and had the Professor of Chemistry at the College examine them, and he had also taken pains to send them to Ann Arbor, to a Professor of Chemistry there, and neither of them had been able to discover any trace of Paris green in them. Two heaping table-spoonfuls of Paris green, if it is good, is a great plenty for an ordinary barrel of water.

Mr. Robinson. Is there any danger of injuring the tree or injuring the growth of the fruit? The reason I ask this question is, I have seen that Paris green has injured the vines sometimes when applied to potatoes.

Mr. Woodward. I have no doubt that if you put it on strong enough it will injure the growth of the tree, it will injure the foliage; and I have very little doubt that the article called "London purple" will be efficacious, although we do not like it as well for the potato-bug in Western New York as we do Paris green.

QUESTION. How does it kill the coddling moth, as that insect does not feed on the apple?

Mr. WOODWARD. I don't pretend to know. My explanation is, that when the apples are still standing up, the Paris green lodges in the calyx, and the coddling-moth worm always begins there, and the moment it commences to eat into the apple it makes no difference how little Paris green it gets, it kills it.

QUESTION. How can the farmers of New England get rid of bushes, hardhacks and alders, in any way that is cheaper and more effective than cutting? Is there any liquid or chemical wash that will destroy them.

Mr. HUBBARD. One of the most effective bush eradicators I have used is a small flock of sheep. They are of great value for white birch and alder, sumach, and such things as those, any thing but what we call sweet fern. If you once cut them down and keep sheep in the pasture, they will keep them down and finally exterminate them.

Mr. BILL. I have kept a great many sheep, and I still find a great many hardhacks in my pastures. I have now got a flock of Angora goats, and perhaps I would recommend them.

Mr. GOLD. Allow me to explain. The hardhack that Mr. Bill is speaking of is not the bush so called in Litchfield County.

Mr. BILL. Well, they are *hard* enough.

Mr. GOLD. One is a *Spireæ*, the other is a *Potentilla.*

Mr. FISH. I think Mr. Bill has got the right thing now, for I think his goats will be pretty sure to kill them out.

QUESTION. How will you account for white beans producing colored beans?

Mr. GOLD. Beans of different varieties readily mix and hybridize. So great is this tendency, that, as I learn from the raisers of beans for seed in the State of New York, it is with very great difficulty that they keep the varieties pure and distinct. They have to be sorted over every year, besides being raised on different farms. Two years ago, a single vine in my patch of white case-knife beans produced handsome black case-knife beans. I kept these for seed, and planted them this present year, and from that single vine of black beans I had black beans and white beans, and almost every variety of intermediate color that you can imagine. I supposed I had developed a hybrid or mixed variety there, from the proximity of the black beans and the white ones, and now I can raise case-knife beans of almost any color.

QUESTION. What will prevent maggots at the roots of early cabbage and turnips?

Mr. GOLD. I can only say that the use of some mineral fertilizers, in preference to animal or vegetable fertilizers, is likely to be most efficacious.

QUESTION. What is the best time to dig sweet potatoes, and how can they best be preserved for winter use?

Mr. ——. The best time to dig them, as far as my experience goes, is just as soon as frost comes in the fall. Spread them in some dry, sunny place, and dry them for a few days, and then keep them in a room where the temperature is from 45 to 50 degrees. The trouble is, they very rarely get fully ripe, but you can keep them until February or March.

Mr. GOLD. A gentleman in northern Ohio, Mr. Richmond, who makes a business of raising sweet-potato plants for sale, and raises them by the hundred thousand, keeps his potatoes by carefully drying them and putting them in barrels, and those barrels are placed in an upper room in his house, in which he has a stove, and he keeps that room at a moderate temperature by the use of that stove, and preserves his potatoes perfectly for seed every year. He keeps hundreds of bushels through the winter in that way. He is located in a northern climate, quite as cold as ours, and where the seasons are no more favorable for the maturity of the sweet potato than ours.

QUESTION. Does he pack them in hay, shavings, sand, or anything?

Mr. Gold. I was in his room, and if I remember right, nothing was used; but I may be mistaken.

Mr. Augur. I would say, that some years ago I was at the home of a friend (Mr. Isaac Pullen, of Hightstown, New Jersey) who raises a great many sweet potatoes, and he told me that one great secret of keeping them was in handling them very carefully. He said, if they were not bruised in handling, and were carefully kept in an upper room, where it was neither too moist nor too cold, they could be kept through the winter. I have found that I can raise all my family want to use, but the trouble with me has been to keep them for winter use. About the middle of November they begin to be watery. They are sweet, but too watery for ordinary use.

Question. Has any one here made any money out of this year's apple-crop?

Mr. Augur. Mr. O. B. Hadwen, of Worcester, has sold a very large crop of apples this year, and although he sold them at a moderate figure, he expresses himself as well satisfied with the result. He feeds his inferior apples to his stock, and thinks he does well by making that use of them.

As far as I know, the people in our vicinity have not lost anything on their apples. I have the bulk of my apple crop, the best part—the cooking apples—yet on hand, with a prospect, I think, of their keeping well, and giving good returns. We have accumulated a good many apples for cider, and expect to turn that into vinegar. We have dried, perhaps, 150 bushels, with the American Fruit-Dryer. But there is another way, in which others are experimenting, and with every prospect of success; and that is, in jelly-making. And there is still another point that we ought to look at. As you are all aware, a great many thousand barrels of apples have been sent abroad this year. Some are asking the question, whether it is not best to cut down their orchards; but, Mr. Chairman, I believe this will be readily admitted, that as these thousands and thousands of barrels of apples are going abroad, they are making a foreign market for us. American apples abroad are acquiring a good reputation, and I think all we need to do is to take more care in planting, and, when we plant orchards, select those varieties that will ship well; and, when we have a surplus here, there is no doubt we shall find a market abroad. If we are careful to raise good fruit—choice fruit—we may be reasonably certain that we can dispose of it at a profit. Inferior fruit will hardly ever sell when there is a glut in the market, but choice fruit will always find a market.

Mr. FISH. Will Mr. Augur tell us when he thinks is the right time to gather our apples?

Mr. AUGUR. This year, as I presume has been the experience everywhere, the apple crop matured a little earlier than usual. On the average, I think the first week in October is a good time to pick apples. Some varieties, like the Rhode Island Greening, come in a little earlier, and the Roxbury Russet a little later.

QUESTION. Can you tell by the looks of the apples when to pick them?

Mr. AUGUR. I think the way they are falling from the trees is a pretty good indication. When we find sound apples falling off without heavy winds, I think we should pick at once, and not let the ground get covered with good apples.

Mr. GOLD. The first shipments of apples to England this year were made the first week in August, and shipments have been continued from that time until the present, and have reached hundreds of thousands of barrels. I learn from the reports given me by shippers, that those apples shipped in August and September brought better returns than the great quantity that has gone forward later. I think some varieties picked early will keep a little better than if left on the tree later, but in most cases the quality improves by letting the apples hang until fully matured.

Mr. AUGUR. You have noticed in the opposite corner of the room specimens of canned and dried fruit. One of our farmers carried two hundred and fifty bushels to a canning establishment and sold them for thirty cents a bushel. He was well satisfied.

Mr. HART. I think it depends very much upon the variety of apple that is raised. I think the great trouble with our orchardists in Connecticut is in multiplying varieties. There are a few standard varieties that always bring good prices, comparatively. The best fall apples brought good prices in New York, and some varieties of winter apples are bringing good prices there now, while other varieties that are considered upon our farms equally good for consumption are a drug; it is difficult to sell them at a profit. If you have fine Spitzenburgs, you can sell them at a profit. Greenings have been so plentiful that they have been very cheap indeed. Hardly any profit in raising them; none in handling them, unless you have special facilities. Fine specimens of the Lady apple are worth now eight dollars a barrel in New York. Those of us who have ever raised them know that they hang in clusters, lining the trees, so that we get a larger quantity than we expected, notwithstanding they are small.

Mr. Woodward. If it is in order, I will give you a little of our experience in picking apples in western New York. We have come to the conclusion that we left our apples upon the trees too long. If you leave the King apple upon the tree until late in the fall, it becomes a late fall and very early winter apple; it will scarcely keep until New Year's. If properly picked and taken care of it will keep until April. Our rule is now, when we find they will come off readily by turning them up, like a pear, we pick them. Some others follow another rule. They search among their trees, pick off the most mature apples they can find, and if the seeds are black they pick the fruit at once. We find those that are picked early the best.

In regard to the profit on apples, I will say that my crop, after paying all the expenses of handling, will pay me twenty-five dollars an acre this year. Last year, my apples paid me over one hundred and thirty dollars an acre, after paying all expenses of handling.

The Chairman. I am very happy to hear of such good success with the apple crop. Some years ago, I was rather susceptible to the allurements of the apple-tree dealers, and rather ambitious to try all varieties of apples; but I should heartily agree with Mr. Hart, that we want but few varieties, and those of the special kinds suited for the market. It is not the best apple that is the most marketable. Perhaps no apple could be selected that would be equal in all respects to the Baldwin as a market apple, while I should consider it a second-class apple in point of quality. I only desired to say a word, and that was that I think I have something over two hundred varieties of apples, but fifty varieties are as many as any man should cultivate, while for market a smaller number should be preferred.

Mr. Gridley. What experience has any one had in drying apples?

Mr. Augur. We have used a dryer, this year, and dried quite a quantity of apples; but my opinion is, that in a town or in a neighborhood where there is a large crop of apples, and a large surplus to be dried, it is better to have a large company make a specialty of it, than to run a good many small dryers. I am satisfied that, where help is cheap, and you can get the right persons to engage in it, and the right evaporators to do the work, there is a margin of profit in it.

Mr. Fish. Can you give us any idea what apples are worth per bushel to dry?

Mr. Augur. A gentleman in Hartford who has two Hamlin evaporators wrote me he had been buying at twenty cents a bushel. He had hoped to get about six thousand bushels, but he had succeeded in getting only two thousand. He had been somewhat disappointed in his anticipations, and he wished to sell out to some one who would be more fortunate in getting apples at a moderate price than he had been.

Question. How to remove warts from neat stock?

Mr. ———. I have a young heifer that has a large wart right in the center of the bag—as near the center between the four teats as it is possible to place it—that precludes the posibility of milking that heifer. I would like to be informed how to remove that wart successfully.

Mr. Fish. I have had a very limited experience with warts upon cattle. There are so many peculiar forms of warts, that no one remedy that can be given will be available in all cases. The best thing I ever tried for ordinary warts is the oil of flaxseed—linseed oil. Ordinary warts upon cattle, particularly long warts upon cows teats, will be dried up and removed quite readily by using linseed oil.

Mr. Cheever. Any wart which can be handled by tying a string around it tightly, can be killed without much pain to the animal. It is a very simple matter indeed.

Mr. ———. I had at one time the care of a horse that had a wart under his tail nearly as large as my fist. I had heard of a remedy that I thought would be pretty effectual, and I told the owner of the horse that I could kill the wart, possibly kill the horse. He said, "kill the wart, if you can, and if the horse dies, all right. I will risk the horse." I took a piece of white potash, let it dissolve in the sun, and with a common brush or flat piece of stick, I applied the potash to the wart. There was also a large flat one on the side of his head, and another one on the breast. I used the potash on them all. The one on the breast came out, leaving a hole an inch and a half or two inches long, which afterwards healed up; the one under the tail all dried up; and the one on the side of the head rotted. It made a very large sore at first, but it dried up. The potash killed every one of them, and the horse was all right. The owner sold him afterwards for a fair price. I have tried it in a number of cases, and have never known it to fail. It is a very simple remedy, and is the most effectual I have ever seen tried.

Question. What are the three best varieties of strawberries for market in the vicinity of a small manufacturing village, soil rather light and sandy?

Mr. Hale. If it is one of those markets that simply wants a supply of strawberries regardless of quality, I should name first, the Crescent Seedling. It is early, and it is enormously productive. Next, of the well-tested sorts, probably there is nothing better than the Charles Downing. Then take something late, to prolong the market, and for myself, I should plant the Windsor Chief. It is of fine quality, and good appearance, but it is so very acid that hardly anybody wants to eat it when it first colors up. Leave it a few days and it is better than the Wilson. It is larger and more productive even than the Crescent Seedling, and very late. It would probably be found very profitable, but there is not a man in this room who would raise it for his own use, if he could raise anything else. I should not.

QUESTION. Do ants injure trees or shrubs?

Mr. CHEEVER. Ants do not injure vegetation, but they are the keepers of the little plant lice. They take care of them as we take care of our cows; they protect them, "herd" them, as it has been expressed, house them. They carry the plant-lice (the aphis) up on the plants, and there they propagate and suck the sap from the vegetation, and the ants milk the lice for their support; they take it second hand. In one sense ants do injure vegetation. A simple remedy is, to wash the plant with whale-oil soap.

QUESTION. What is the value of ground limestone? How does it compare with plaster?

Mr. WHITTAKER. Ground limestone is carbonate of lime. I doubt very much whether it has any beneficial effect on vegetation.

Adjourned to evening.

EVENING SESSION.

Vice-President **Hyde** called the meeting to order at half-past seven o'clock, and introduced as the lecturer of the evening, Mr. J. B. **Olcott**, Agricultural Editor of the "Hartford Courant."

THE AGRICULTURAL PRESS.

BY J. B. OLCOTT.

Ladies and Gentlemen:—We come in at the end of a feast, but neither the farmer nor newspaper man should be ashamed to gather the fragments, that nothing be lost.

Our good Secretary has given us an opportunity of studying the Agricultural Press. This study should include an allusion, at least, to the beginning of literature, the manifold record of learning by the use of print, and some notion how tolerable farm common-sense exists without either. Such a study must touch society, and modern civilization also.

Lacking the time and taste for arduous labor, we shall play around the subject, "giving a lick here and a promise there"—as weeders do in hay-harvest—leaving the heft of ancient historical work undone. It is sufficient, perhaps, if we range our present thoughts in line with history, and endeavor to see or guess at the past by holding the present at arm's length, if we can, while we look at it.

Literature began with the first story of some great event or noble deed that lived in the memory of men. Writing and printing translate, duplicate, and propagate the immortal record of human life which existed before and continually grows in the heart of mankind, strengthened, renewed, and corrected by daily experience. Literature is the outward manifestation, the top only of the perennial plant—like grass, or the smell of grass—compared with the everlasting roots, deep down in the very being of the race. So we may imagine, if we please, that a very tolerable common-sense, regarding so important a matter as the soil, in its relations to man must have existed, before the minds of any were artificially lifted very much above it, without print, without writing, without speech, even. Only the other day I was bossing a gang of diggers to whom I could only communicate my views of goodness by signs and motions.

The pother about culture for the soil, Mr. Chairman, comes up now as it never did before, because the necessity for digging and dunging it to live, while we cultivate ourselves, stares us in the face now as it never did before. We have been living, in America, as respects our soil, like mice in a fat cheese, developing under these favoring circumstances the fancy that culture and education for ourselves, and culture and education for the land were not reciprocal, but two separate and disconnected things. Now, sir, modern science, religion and morals, let us hope, working hand in hand, are teaching us that culture for ourselves and culture for our gardens are interdependent and inseparable: joined together by eternal goodness and not to be sundered with safety by anybody. To rob the earth leads, like all wrong, to barbarism, as the care and culture of the earth, keeping it holy everywhere, as God pronounced it good, is the highest evidence and natural accompaniment of the truest civilization.

Agriculture of the kind that merely strips the land is as easy, comparatively, as gutting a fish. Any boor can do that. But when we come, Mr. Chairman, to keeping the soil whole—a sacred trust—while transmuting its parts to our daily uses, human training, culture, and education, as well as all manly honor and honesty, find their match.

Again, agricultural literature may be likened to a thrifty branch of the great tree of general literature, now rapidly coming to overshadow the earth, obscuring the heavens and emulating the sun. We look into the morning paper now, you know, to see whether we had better take our umbrellas along or not. The obsolete old farm judge of this changeable climate is frequently stopped on the road, however, by some more literary party, anxiously inquiring whether it is going to rain. Like an old-fashioned farmer, our national weather department necessarily covers a great deal of ground. It's "areas of rain" and allowances for "local" chances, though ever so cleverly expressed, will always leave occasion for private judgment in securing our hay crops and taking care of our picnics.

Of the antiquity of the Agricultural Press there is no telling, exactly—an early type was a duck's foot in the mud. Put your finger where you please and say the imprinting of agricultural ideas first began there, and some fellow will show you the complete thing away back of your point of genesis. As legal heirs of the birds and beasts who printed their geological tracks upon the new red sandstone, we in the Connecticut valley may claim an early right to their types and presses. Or, we might say, to start with, in the privacy of this audience, that the Agricultural Press of our time began with the *Connecticut Farmer.* The least of a philosopher, however, will show how that journal was developing in our common-schools, by the multiplication of books and pens and ink a century ago. Where a multitude learn to read a few will learn to write. The newspaper has no hold without trained readers. It is so founded upon the general habit of reading, that we may, if we please, regard every newspaper as a guarantee of popular education, and we may hope also of general prosperity—unless some sour social science shall prove that all human institutions are of a parasitic or fungoid nature, caring nothing for the life they live upon.

The existence of a newspaper depends upon a republic of readers, who are able to pay for their reading, and will support their favorite journal in multiplying the good word as no single tongue can do it. The *Farmer* newspaper, let us remark, in passing, with its broad pages of correspondence from all over the commonwealth, grows right up in the face of a retiring generation which declared against "book farming" and the printed word. But who tilled the soil the *Farmer* grows in? Every studious parent, every hard-working teacher or clergyman or physician, every agricultural writer inside the State and every one outside, had a hand in it. Like all else upon earth it never sprang from nothing. There are no more self-made newspapers than self-made men. The newspaper of to-day, like the vegetation of to-day, grows in the ashes of a thousand aspirations and a thousand failures.

Elderly men remember with affection the *Homestead,* started by Messrs. Henry C. Dyer, Clift, Gold, and Weld, under the creative influences of their time. I should like to hear Secretary Gold tell how much money he lost by it and how he lost it. Between you and I he never lost a cent. He only paid what was due for an education in that branch of the publishing business.

Before the time of the *Homestead* we were not destitute of agricultural reading. Beside the stray books in circulation, of greater or less value—books are proper farming tools and contain the seed germ of newspapers, we must understand,—there was a distributing center of agricultural matter over Albany way, and coming across the mountain by coach once or twice monthly. Was not the first American "Farmer's School Book," written by J. Or-ville Taylor, author of the "District School," and other obsolete works, and printed at Albany in 1837? The vigilant farm-mother of those days generally had a parcel of back numbers of the *Cultivator* stitched together and safely stored away in the garret for rainy days and winter evenings. If she read them the boys surely did, and the present speaker thankfully remembers the grand chance he had up garret to edit and reconcile the conflicting farm opinions of that time.

Somewhat later Orange Judd, the Connecticut school-master, began to preach, write, and print agricultural news, illustrating the same with such wood cuts as the rising pictorial art of the metropolis could afford. There is no probability of our overestimating his influence and that of his helpers in fashioning the agricultural common-sense of these times. His rude pictures spoke in the eldest written characters to those even who were too young in years or civilization to understand the print of the ordinary letter-press.

A whole evening might be consumed in mentioning the writers who have wrought in the agricultural field. If our minds only contained that which had not been written they would contain very little about agriculture. A newspaper author writes upon the sand, leaving his work to be effaced by the next tide of opinion, and generously allows every day and generation to make up its own mind; agricultural arts are lost and rediscovered every day.

In the briefest notice of farm literature it will never do to omit Mr. Thomas' *Farmer's Almanac.* That came but once a year, cost but six cents, giving the rural agent—perhaps a post-master or storekeeper—a chance to secure his copy free, and was taken by everybody, for everybody was then on a farm or had but recently left one. Mr. Thomas' weather predictions were always safe and seasonable,—not so alarming as those of recent prophets. His calculations for the moon and the tides were reliable and his paragraphs about monthly work were done as if he had but just come in from a timely job. They are models of a certain class of farm paragraph-writing to-day. The *Almanac* receipts for cooking ordered nothing beyond the means of the well-appointed farm or the country grocery. The domestic economy was frugal, the directions for making cider and sausages were sound, and the advice to use rum in harvest as a "cooling" drink was highly popular. We might consider Mr. Thomas as the father of our Agricultural Press and not be far out of the way.

And yet it must be said that at no time has the Agricultural

Press been quite in the heart of our agricultural life, and perhaps never can be. Agricultural print is but the shade of agricultural talk, fixed so that it stays awhile—possibly to shame the authors after the use of it, if it ever had any, is done. Through the temporary press great communities of men may rejoice together and suffer together in a way that could not be by the transmission of ideas in the slow way of the pen and human speech alone.

As the press is a shadow of human speech so it is subject to the faults and errors of speech. Sometimes I think of print as the fellow did of rain that "it does about as much hurt as good." The benefit or harm depends upon how we manage. Wise farmers will never wish to forego the rain, because at some time of their lives they got their hay wet; neither will we abjure the ready communication of ideas through the multiplication of copies by types, simply because bad ideas will sometimes grow with the good as chaff and dirt grow with grain. The proper remedy for chaff and rubbish anywhere is to ventilate,—let the wind in and keep a trusty hand blowing it out. After all our care, we may remember that but for the existence of the refuse to get in our teeth once in awhile, we could have no abiding and constant evidence of our care and cleanliness.

In commending the particular guardianship of the press to the farmer—the isolated farmer, scattered abroad over the land—it should be shown how he may be especially benefited by it. In respect of agreeable speech—soft preachments, amusing lectures, or essays, read to a congregation of men, the people of our communities have no advantage over the crowded cities of ancient times. The patriarch Lot, like an isolated farmer, could pass his story down to us probably easier than he could have told it to the cities of the plain, where doubtless orators, more in agreement with the fashion of that period, kept the ears of the people. Ancient Greece and Rome had no end of lectures on every possible topic. Athens, in her glory, like a sound head upon a decrepit body—if such a term is admissible—died possessed of an intellectual wealth for the world that *she* had no adequate means of imparting. So of every extinct city. They could accumulate but could not distribute their stores of learning among the hills until the day of rapid reproduction of the shadow of thought by types.

The most enlightened and wickedest of the old cities enjoyed a milder climate than we do. Their citizens could walk in their gardens and bask in winter sunshine while listening to their philosophers. The polite, refined, and cultured of the ancient world might concentrate themselves and enjoy one another's company to the point of enervation while the outside world—just outside their own doors,—was growing colder and poorer and more barbarous.

Possibly some one will wish me to say here that the grand idea of enlightening the whole world never occurred to anybody till about St. Paul's time. He was a master hand, we must allow, and his epistles prove that he would have made a tremendous newspaper man, but he didn't begin the good work any more than our Mr. Thomas did. Every generous spirit, everywhere in all time, we find to have been more or less consumed with the idea of telling good news to everybody.

But for the press our farmers' meetings would be but small affairs and would scarcely pay. Men gather here from their distant homes at considerable expense and a great deal of trouble and inconvenience. The citizens of the town relinquish their quiet firesides for a hot and perhaps crowded hall to hear a lecture under constraint, while books that are more entertaining lie at their elbows. A strange audience fails to catch the meaning of a strange speaker and goes home dissatisfied, but the nonsense may be picked out of the doings of this convention by the farm boy, over his churning among the hills, or at any odd moment and without regard to the tedious formalities of our programme—thanks to the mechanic mystery of types.

Some of our friends are greatly exercised about the tendency of the times towards centralization. Too many people go from the country to the town, they say. I am the more concerned that people should ever mistake their avocation and go into the country to suffer privations they are no way fitted for. One of the uses of the agricultural press lies in so informing the reading public that they will not be likely to make mistakes. Many of our readers are city readers with farm desires. By studying a printed mirror of farm-life they pacify their rural instincts, keep more or less in intellectual accord with their farming acquaintances, and remain content as they are, a most valuable and catholic body of people, friendly to agriculture and having a thoughtful understanding of its embarrassments and trials. Many of these keep themselves in full communion with rural life, through their plots of garden ground and perhaps some small stock of domestic animals. Whether they remain in town or make annual or total migration to the country for excitement or contentment, they have much to thank the agricultural press for.

It would be easy to show that neither the press, nor railways, or steam, or any modern invention necessarily hastens or increases the centralizing tendency. Our ease of communication rather prevents undue centralization and makes centrifugal action possible whenever it becomes wise or necessary. We perceive, everywhere, that cities are no longer a close monopoly. We build them out west in a year, or five years, and desert them in less time. The railway must carry as well as fetch, and like a good rule works both ways, if the people please to have it so. Anything like illiberal conduct in a city ends in varicose action and the development of other centers of industry and population, thanks to the press that must reflect day by day the faces of the people, and thanks especially to the politic conduct of the agricultural press.

The way of all the dead civilizations was to deplete large spaces to benefit a small one—a make-shift style of farming, bad for all concerned. Society, like the individual, in order to live, must continually send warm blood to its extremities. Broad, Christian views, we may reasonably hope, tend to unite the world into one sympathetic body—not in a year, or a hundred, or a thousand years perhaps, but by gradual growth in grace, as antipathetic races are continually being born and born again in closer similitude and contact of mind with the highest type of goodness, through the agency of the press and the amenities of society and commerce.

Doubtless bigotry may be as latent in agriculture as in religion, unless the greatest liberty of speech and opinion is allowed. I have read that in China the least act in life is regulated by law or custom, and we may presume that whoever introduces a new bean risks having his head cut off. This is not so in our agriculture, as yet, but may become so in time unless we are careful. So many sorts of people are coming to dwell among us, bringing their household goods with them, precisely as we boast of permitting them to do, and our agriculture has become so exceedingly mixed that tyros in the business can scarcely make head or tail of current teaching. This state of things is not to be regretted. This is true happiness, such as all ages have prayed for, when the utmost liberty of choice among good and evil obtains, pretty much, so far as I can see, as it did in the Garden of Eden. We can't wash our potatoes, nor bolt our meal, nor strain our milk or honey for all time. These are constant duties, always with us. Neither can we prevent the occasional rising of odd points of doctrine—doctrines which appear like heresies, and cause old agricultural roosters to look very much askew, and give out their most peculiar warning-cry of alarm. It is among the promises that we should have new things, and we must be continually and devotedly looking for them like the wise men of the East. Let us pray that the Agricultural Press may remain open to conviction and help keep us free from bigotry and the fear of every new bean that comes into market. Since the advent of the bean weevil, it is more than ever to be remarked that we cannot live by beans alone.

The mystery of types is a very old thing, Mr. Chairman. The Chinese were printing their wisdom and superstitions while our not very remote ancestors were drinking from their enemies' skulls. Here we see that the art of printing alone is not all that is necessary for our salvation. It is nothing in these paper-making days for farmers to have a newspaper. Every craft and every trade has one, as I have read that every sort of industry had a trades-union in ancient Rome. The great question with our agricultural journal is, whether it is to be a narrow, class affair, or whether it will comprehend and understand the entire world of legitimate and illegitimate industry it is called to support? Is our coming agriculture to know—to use the rough but expressive speech of Carlyle—who and what it is that is dancing jigs upon its belly? It is a very curious circumstance that our wisest politicians, our greatest theologians, our most eminent men of science, our acutest financiers, business men, and politest society, do not succeed in keeping the nation from scrapes and pinches that nothing but a draft on the farm, in some shape, will help them out of. To the real naturalist the circumstance is not curious at all. He sees all human institutions as a growth out of the ground—now a fungus turning everything to decay, and now a tree of fair fruit, producing refreshment for the land. What we want in our agricultural press, and upon our farms, is a discriminating insight into the tendency of what grows out of the ground. If we cannot have that then our art of printing shall be of little acconnt, for the story of our new civilization is an old story that has been told a thousand times.

We have alluded to the manifold character of the press. How it takes on as many forms as there are classes of industry. How it is divided into the pettiest subdivisions of sects and parties, and each minor class has an organ. I wish our farmers would look over Rowell's advertising list of newspapers and see for themselves with what a grand superstructure of paper the land is being roofed in. I wish our farmers who desire to educate themselves, and their families, into what is going on in the world, would spend a shilling or a dollar now and then, in buying copies here and there of the various journals in circulation.

Which, pray, of these thousand branches of the newspaper tree shall take the lead? Which stands most erect upon the main trunk? Which has the most direct connection with the tap root? Which is most immediately concerned with, and has the best understanding of, the dust of the earth from which it was created? Which evinces the closest, finest, and most wholesome appreciation of human nature? Which grows towards goodness, and points towards goodness, and leads towards goodness with all its might?

I do not propose to answer these questions, Mr. Chairman. My opinion is that it takes nearly the whole press at present, to tell the grand story of human development, from the *Namby-pamby Gazette* upwards. Every editor and every publisher does the best he can. Every class must learn to read something. The vilest news sheet is always considerably better than its patrons, and it does not grow in grace any faster because its patrons cannot support it in doing so.

In regard to the Agricultural Press, or any part of it, the same conditions are true. We have to grow the crops and make the Yankee notions that people will pay for, don't we? The farm press takes no higher plane because its subscribers cannot stand on any higher plane. Every man, in a sense, makes his own newspaper. We can't lift ourselves by our boot-straps. Nothing but laying hold of some ideal goodness to be wrought into practice if we can will ever raise us one peg. Some trace of divinity will show in the meanest journal, thank God! though every print is a paper cast averaged from the faces of its patrons. My critic will allow, perhaps, that the average human mug must be a great deal handsomer than our hooked, or crooked, or pug noses individually are, and beauty or goodness on a similar scale is all any journal will claim for itself.

The newspaper man sometimes satisfies his conscience in regard to the quality of published work by saying "all men write now, that one man may read, and of course all must be wiser and better than one." This is smart, but not exactly true, for all men don't write, and sometimes the quality of printed matter is so bad that we have equal occasion to be thankful that every one don't read.

The truth, however, which sticks out of this whole subject, whatever way we stir it, is that if we want better newspapers we must do better and be better ourselves. Nothing but ignorance on the farm prevents the Agricultural Press from taking higher ground in food, finance, politics, and religion. But for that, every press would teach the soundest science in law, medicine, agriculture, and commerce clear away down through each advertising column. By your books and newspapers shall we know you, and know how your money goes when you get any. The old story of the aged farmer who begged some one to take the good book and read him the history of Samson and the foxes had more than a grain of truth in it. Our farm employment is sometimes rather heavy, and our farm reading is sometimes correspondingly light.

Much reading that is not intended for farmers at all would be more profitable for them, sometimes, than that which is specially designed for their use. We never profit much by people who agree with us exactly. Many channels of information are public, but they remain unused by farmers, and continue curiously private and secluded from the agricultural gaze. Steady-going members of the agricultural press scarcely know what is going on there, and the rank and file of old-style farmers never do. I can safely recommend my farming friends to get, once in a while, a copy of the journals that wait upon other and more pecuniarily successful trades. There is the *Paint, Oil, and Drug Reporter*, for instance, just now chock-full of provoking items. I never used any Paris-green, but if I have occasion to I shall certainly find out why it costs so dearly, while arsenic itself is but 2½ cents per pound.

Let the farmer be well informed upon every subject. It is a disgrace to his newspaper that he should be continually cheated by travelling quacks of a bogus scientific, religious, medical, or financial character. Piles of money go out of ignorant farmer's pockets that we know of, and piles that we never hear about because the losers are ashamed to tell. The loss of an honest man would not be so deplorable if the money did not go to feed nests of rogues somewhere, and give them a bold front to take on new disguises, and extend their depredations still wider upon society. The law is of little service, for these nimble cheats in protean shapes whip in before the law, and get clean away with their plunder ere its slow and costly processes can be brought to bear. Reliable "business" and even the best "religious" connections do not prevent a farmer from being cleaned out of ready cash in periods when popular manias are prevalent. Nothing holds the purse-strings at such times like a long course of level-headed thinking upon a variety of subjects, resulting in a crop of decided opinions. It is safe to say that no culture, or manure, is better for this crop than the use of a liberal and fertile press, full as an egg is of meat of the varied experience of mankind.

The too light reading of the newspaper can be corrected on the farm with the weightier matter of periodical magazines and books. There was a time when the farm-house was as well supplied with reading as any house in the land. That was when nobody had anything but the Bible and the almanac. The farmer having more time for study, more time for reflection, and a greater variety of employment indoors and out, then than now, he was very apt in New England, at least, to pass for a man of better education than the common run of men. But the farmer has scarcely kept pace with the press or the rest of the world. He has neglected his Bible, and let his church horse-sheds go to decay. He moves by an ox team while the rest of the world go by steam and electricity. He never buys a book unless some agent forces it on him by main strength, nor reads a magazine or a good, modern novel—that most vivid of truth-tellers, even better and more entertaining in its way than the story of the fiery-tailed foxes among Philistine corn.

Perhaps some objector will point me to farm-houses that have tables and shelves filled with books. There are a few scattered here and there, let us thankfully admit, but will the books bear a very close examination by an expert in books? Where there is one farming family making a tolerable show of books that are not, perhaps, calculated to provoke and inspire very vigorous farm thought, there are ten or twenty houses that get little or no excitement from literature. It will scarcely do, gentlemen, for us to reason that, because we have a plenty of good books, our poorer neighbors have also. Once upon a time, under a strong sense of duty, I did succeed in placing a couple of copies of "How Crops Grow," and "How Crops Feed," in my district, and I feel sure they stand there as land-marks yet. The very titles are suggestive and inspiring. I never dared to ask whether they are read or not, for fear of a disappointing answer. I like to fancy that they are opened sometimes, when hard words occur incidentally in an agricultural paper, and that the owners will learn there how differently a scholar treats a subject from an agent or trader who has something to sell. Perhaps some gentleman present will rise and tell me that his district is full of copies of those works? There is another very suggestive book, of an entirely different class, recently published. It is a genuine book, genuine as the moon is, although it shines a good deal by reflected light, as the moon does. It is one of a class of books that we have very few of in America, a class of books that I hope in due time we shall have more of, wherein a cultivated man spends some years in cultivating his farm, applying all the science at his command, and then writes out his conclusions for his neighbors. I refer to Harlan's "Farming with Green Manures." The sale of good farm books in any section may be readily estimated by counting the copies of that one, already purchased there. The author would have stood a small chance for showing his peculiar views in an agricultural newspaper. In the narrow space allowed the notions of one contributor he would scarcely have been understood and appreciated. Dr. Harlan requires the space of a book and a continued session with us all by himself, to give us the best of him. In buying such a book, upon a subject perhaps, that we have discarded while the author was making it an earnest study, we buy the whole man as far as that business is concerned, and can digest him at our leisure. The agricultural newspaper expends our time upon a multitude of topics that often neutralize one another, while continuous communion with the mind of a wise man, situated somewhat as we are, enables us to absorb his spirit and apply his experience and learning, to the strength of our own private concerns.

Possibly some one may be enquiring by what right the present speaker has so much to say of newspapers and books? It is not enough to plead the invitation of your secretary, nor even enough to justify his choice by a smattering of learning in treating my subject. The farm-boy among the hills, reading his annual report while he churns or baits the cows, may wish me to turn state's evidence and tell exactly how this thing began. In the winter of 1844, not finding a place to work for my board and go to school, I went behind the press as a roller-boy, and printer's apprentice, became a compositor, pressman, and journeyman, familiar with the old book and newspaper mechanism. The mechanical part of the trade, without which nothing is or can be done, has run away ahead of those days, but the grand philosophy of the business—the essential fact that anybody who knows it has a right to tell the news—will remain the same for all time. We are apt to forget this right, though, and interested parties are continually trying to make us forget it. There is always a great temptation for managing men to disguise and shape the news for their own advantage. You will smile at the idea—you will think it impossible that free communication of thought can ever be so obstructed as to bring on a dark age, when all learning shall cease to exist, or remain a monopoly to be drawn out of certain faucets under the thumbs of a few. Yet there are signs of such a consummation already, in the trifles with which the people are being amused, while one by one the items of their independence are slyly sequestered from them.

Not once in the world's history, be it remembered, but always, do the harbingers of salvation for the mistakes of civil life come from the wilderness, eating their locusts and wild honey.

Not once in the world's history, Mr. Chairman, but always, do scholars—wise men—yearning for positive knowledge, take counsel with shepherds and herdsmen as to what the signs of the times portend. The coming civilization will continually desire, let us hope, to make both ends meet in counsel in that way. City and country must have their annual settlement. We of the farm want to know how you like our crops? and we of the village and city want to hear how you like our drainage?

Great social questions never can come squarely into a newspaper unless there is a rumpus kicked up about them somewhere. That is where your farmer's meetings come in; if the people don't stir beneath a newspaper sheet, it is like a sheet spread over the dead.

When, with all our schools, and all our talk of higher education, we are raising young men on the farm that don't know enough to head up a barrel, or build a hen-coop, it is time to call a meeting of inquiry, and set farm newspapers at work on a new tack. When our school fund pulls in a string of farm mortgages because society has forgotten how to live from the soil, and Connecticut real estate is no longer considered the best security for money, it may be considered that we have educated the children off the farm long enough, and that some agricultural reading, at least, should be put into our common schools.

My master in printing, like many of the old masters, worshipped a standard of excellence for the press that some would laugh at in these days. He thought it a means of grace and goodness, rating it not second to any means on earth. He was bred on a farm, made very light work of starting a newspaper. He started a good many of them—the first while but 18 years old. Any studious and attentive farm-boy may enter the press-gang. Life is short, but art is long and hopeful. The agricultural press will need many recruits. No one can speak for the land more truly than those who were but lately extracted from it. If need be, let us plant the printing-press directly upon the soil. Is there no room in the farm-kitchen? Look into the old, low-browed farm-houses that were once mills and factories, all that we had, and doing everything that was needed. See the narrow space wherein our grandmothers manufactured wool, cotton, flax, and silk, carding, spinning, weaving, and dyeing and making business boom every working day in the year! There is nothing in the manipulation of types and presses, or paper, or ink, or ideas, even, that would have staggered that sort of people. It was the energy, patience, and power of organization and scientific imagination bred among the difficulties of isolated farm-life which made our present factory system possible. Wise men are thinking we have latterly been losing the old leaven of independent goodness derived from the farm, and need rural nurseries of hand-work to keep our steam-engines from running off the track.

There is no reason why a bookish farm-boy should not learn to make books upon the farm, nor why farm news should not be printed there, at headquarters. There are plenty of types and presses now, adapted to small beginnings, and childhood is the time to start learning any art.

The knack of writing one's ideas readily comes of early and continuous practice. The gift of the pen is second only to the gift of speech. Let the children begin to handle it early. Let them learn not to be afraid of it, any more than they are afraid to use their tongues. The art of writing, folding, and addressing a letter, plainly and neatly, is too rare an accomplisment even among educated people The advantage of a good address for the young shows as plainly upon paper as anywhere. One who is naturally and continually embarrassed and hindered by personal contact may come to a full power of expression in privacy with the pen. Let the children learn to write letters freely to their brothers and sisters, cousins, and their mates in school. Let our youth learn to cherish a sweet and generous friendship by correspondence while youth gives leisure for knitting friendship. The practice of description with the pen among one's familiar acquaintance is the best primary-school for writing. It trains the eye to see and the mind to think truly, and gives an opportunity for self-criticism and correction.

Refrain from print as long as possible. Why should we trouble ourselves to say in public what another may presently say as well, or better? Perhaps the necessity for printing may never come, and the force which might be wasted in words is reserved for deeds. Don't let us make up our entire lives of writing or reading. Writing of what might be is to be doing the thing that ought to be what the flower is to the fruit. We can't make a whole life of literature or music, any more than we make a full meal of oil or honey.

The best writers have sometimes been those who were estopped from action—or those who could not act in some necessary direction without the help of all goodness in their fellows. Prisoners, confined by the limitations of their own time, have spoken to and helped call into existence the possibilities of future times. We write, as we pray, for what we can't get without. We write in our extremity, when we must, and so develope by association with other minds latent powers we did not know we had. There are natural and inherited tendencies toward writing, though every babe is a born savage forced to climb up the old rugged hill of learning. This is where the frightful necessity for education comes in. What good thing we know dies with us, unless our children or somebody's children learn it. For our comfort it may be observed, that the foolish things we have learned stand a fair chance to die with us too.

The labor of writing a paragraph is not to be estimated by the time employed in the act. A hen drops an egg in a brief period, but the whole day, at least, comes round before she can repeat the performance, and yet she has time for other things, such as scratching around home, as the busiest farm-writer may have.

The means for writing may seem very small to some, but to me the means for farm-writing always appeared to require acres and years of experience. The line of truth scanned in a moment might have been twenty years growing into the fiber of the author's mind. Thackeray speaks lightly of his literary tools, his pen and ink, and quire of Bath post, wherewith to earn his righteous guineas, but I believe he didn't earn money with his pen to speak of until after he had spent his patrimony, failed as a painter, and acquired a vast store of social knowledge.

One reason why the cultivated farmer needs ordinary books less, is because a new page of the eternal book he is most interested in is being continually laid open before him every morning. One reason why too many farm-writers fail to interest us is because they do not transcribe from that original page, but from copies, and copies of copies of it, that may sometimes not have been well taken in the first place.

A farm writer's rendering of his own views may appear quite flat to his fellows, because he sees only from a single stand-point, instead of securing fullness and depth for his pictures, and by observation and a shift of positions giving them a stereoscopic effect.

One reason why a farmer must not occupy himself continually with ordinary books is because the farm-page is such an absorbing and profitable study that the lives of generations in close perusal of it can never exhaust its occult, ever-changing and inscrutable meanings. With a truly progressive and prosperous people, the unknown good, worshipped yesterday in fear and trembling, becomes eternally the common food of to day. In the light of this thought we see how it is that all educators, and agricultural teachers especially, must ever be capable of educing and inspiring us with good things, both new and old. The matter we sold so well last year may not pay the cost next season, while some unthought-of or forgotten product may be greatly in demand. By a natural insurance the machinery of our farm schools must rise continually, Phœnix-like, from its own ashes. Our boys can't wear our clothes, walk in our tracks, nor be trained in our ways, exactly, and profit requires that newspaper prophets should see visions of the past and visions of the future that every one does not see.

Of scientific agriculture as the future hope of the world, it may be remarked that all other foundations for permanent civilization have been tried and found wanting. The superstructure we call society, blossoming in the garden of fine arts, fails like a run-out meadow, unless the bottom-soil of the world be continually redressed with fresh ideas. Artificial cities and forced empires have fallen to indistinguishable dust, over and over again, and haply for subsequent mistaken civilizations, if the common people have remained pure and unadulterated, subject to superficial artifices in the future.

As a "thick bottom" of fine, hardy grasses make the bulk and bloom of the perennial hay-crop, so will a thrifty rural population lie at the foundation of perennial society when we find it. Our fathers have been deceived with that kind of farming which destroys the permanent sward to make a few annual grain or forage crops for exportation, and that kind of statemanship which turns under the hardy, indigenous classes to give temporary life and power to exotics. Some of our politicians would practice rotation of races ere they have studied the proper rotation of crops.

Our old theologians had such small science of goodness as to continually forget the infinitesimal seed of David that could have developed in the first century of the new era, and Christian history is still running away with the notion of heating a national kettle of fish from the top. Whether farm-journals will teach a truer philosophy of peasant life and inspiration remains to be seen, Printing serves to equalize the intelligence of our blunders so rapidly that there is ground for a reasonable hope.

Connecticut agriculture is harder because so many of the people were not, by inheritance, of thorough-bred farm stock. Descended of islanders, they are web-footed, in fact or in imagination, and as ready to plow the sea as the land. This fact alone would prevent, in a great many families, the accumulation of agricultural wisdom particularly and justly adapted to one locality. Our oldest and longest-settled districts are yet scarcely discovered, as it were, in their relation to any variety of crops.

It is easy to quit the farm, but almost impossible to get back again as we were before. When a generation has grown up in ignorance of the great original farm print, and is all untrained to read the face of nature, then is the time for pen and ink, the printing press, and many faithful renderings of farm life. When the farmer finds his children and grand-children so innocent of agriculture that they can't afford to take his land as a gift to live on, then may he put out his tongue and sweat over his letters as a matter of duty.

Perhaps I ought to tell some one here what sort of paper to use in writing for print. A sheet like this one, cut in two lengthwise, will do. A letter, or foolscap sheet will make four strips. This narrow shape is less in the way of the compositor as it lies on the case of type before him. The printer has rights which a scribbler is bound to respect. The shorter lines are easier for the eye to follow than long ones, especially if the hand-writing is at all crabbed.

The first concern of a writer for the press, we must presume, is to punch his meaning clean through to his reader's mind so that few questions need be asked. His script must run the gauntlet of editors, compositors and proof-readers, none of whom may have seen what he sees, but each will know his manner, at sight, by his paper and the looks of his goose-tracks, just as quick as an old farmer knows a mower by his swath, or a chopper by his kerf.

Little things deserve attention in this connection. In addressing a letter, let us call the hinge side of the flap the top edge of the envelope; then our correspondent may know at once where to rip for the contents. Put the postage stamp on square and snug in the right hand upper corner, every time, so as not to bother the stamp of the post-office clerk. Address *The Courant*, *The Times*, or *The Farmer* and don't go humbling yourself to the editor at all. Don't mind the editor, but see that you have something to say to his patrons worth reading.

Everybody says "write on but one side of the paper," but that is most imperative in hurried daily offices where copy has to be cut to appease several compositors at once. These are a few of the obvious little things—like cleaning the nails and teeth—to attend to. They are not the weightier matters, and may change to other economic fashions. If the trifles are done, it may be presumed the greater ones will be. The hay he gets don't amount to much, but we like to see a hay-maker drag his rake as he crosses the field, all the same, because it shows that he is minding his business.

It would please me, if I were an editor, to see a young farmer writing straight across unruled paper. That's an accomplishment, like driving a straight furrow. To get the capitals on right and punctuation points all in correctly, are necessary things to do. Many writers neglect the latter, but I don't thoroughly trust a business man unless he punctuates his letters. Wrong punctuation is like a misplaced switch, that throws a train of thought off the track.

Editors don't dare to lay down such strict rules as these for fear they would get no correspondence, but a well-written letter is good for their sore eyes nevertheless. Some farmers who do none of these things quite right are still most excellent farm contributors, because their words are short and pat, their meaning so clear, and their sentences hang together like the links of a chain.

Some editors are too notional. A nice sub-editor once found fault because my slips of paper were not of equal length and my habit of writing closer in some places than others prevented him from estimating accurately the matter to fill his pages. Being pretty busy at the time, I quit him, but I have always been sorry that I did not try to please in so small a matter. Let us make it as easy as we can for editors, since they have to stand and hold open our peep-hole at the world.

In the form of communications there is a great variety. That form which sits easiest on the writer is best. Plain English is a good enough form. A person once came to me and said that he thought he could jerk just as good a paragraph as I could, when once he got his hand in. But what bothered him was how I managed to stop at just such a length—each paragraph a little shorter than the other, up through a column. He didn't see how so many various topics could be writ to a size in that way. I had to explain that paragraphs are sized according to the stuff there is to make them of, like bundles of grain, and then assorted afterwards by the printer.

With the agricultural press it is a good deal as it was with lawyers in Webster's time,—and is now, I guess—"there is plenty of room on the top shelf." The martial spirit of the rising generation has to be trained to fighting its lice, and the entire kit and boodle of minute insect and infusorial enemies. A rugged young nation like ours must cultivate the arts of peace or of war. Some rising agricultural writer is going to immortalize himself by showing how malaria never troubled the smoke of the old back-log, or lurked among the porous shingles of garret bedrooms. Some farm-newspaper must screw its courage up to saying, "Thou art the man!" to the king—of corporations.

In all the country we have something like a hundred and fifty journals devoted to farming and kindred pursuits. Some are merely advertising sheets with scarce enough agriculture to disguise the trade circular. All, so far as I know, are more or less engaged in trade, and some deal in all manner of goods. The best mean to keep their skirts clear of obvious swindles. A cash advertisement is a strong temptation to a printer, and there would be a more lively satisfaction in taxing the advertising sinner in support of a righteous press if some innocent reader were not often out of pocket by the means.

A newspaper can well afford space for whatever will arm and strengthen its patrons in the battle of life. But to study the necessities of a great and varied class is an immense labor. Few farmers dare confide their wants to a personal stranger, even if they know how to tell them exactly. The best of them are too spunky to confess their needs, when a little judicious publicity might bring help from unknown quarters. Those who have the faith and foresight to ask do often receive. The good newspaper family is a sort of a church wherein the widely-separated congregation is never put to the trouble of assembling, and wherein any honest and sincere reaching towards goodness is very likely to be rewarded. Of course, as I have said before, in effect, if we were more righteous and devoted ourselves we should have more righteous and devoted agricultural papers. Journals then would be able to speak with power and authority in defence or protection of any injured member. But, so long as we can look calmly on at the wrong that is being done to a neighbor in his estate or person or family, we need not expect that our favorite journal will do more—even in our own case—than to record the fact as an item of news, after prevention is too late.

Newspapers are proud of fresh news—yet the details of the last murder are as old as Cain, and whoever truly loves Cain, or Abel either, in their descendants, will desire news in time to prevent the hatreds which cause murder. The news of the last rebellion is as stale as an account of the first one would be, unless it helps us to blight the cancerous seed of bloody rebellions. We want the news quickly, good or bad, and it is better that great corporations should assist the traditional gossip in gathering it, if it can be served with a true philosophy of the cause and growth of social events. Our last civil war did not come by good farming, and the next one will not be prevented by it, unless our planters are led to a more profitable use of the bayonet in weeding out things which have been proven injurious.

It would not be surprising if our statutes should require overhauling in the interest of society quite as much as in the interest of agriculture. I would rather not see this matter taken up by an exclusive agricultural journal. It is better for classes as well as individuals to train themselves to regard jealously the true well-being of others. Our methods of taxation and our land-laws need looking to while society grows, as much as the garments of growing children need looking to. A reading of our "flowage" act, as it stands, would probably surprise our brethren of the hills with the summary manner in which an intervale farmer may have his property sequestered for private benefit and the facilities furnished for drowning him out according to law.

My own efforts in writing for print have not, as some of us know, been directed in strictly agricultural channels. They have appeared in a newspaper that is devoted largely to matters of general interest. I should be loth to pass this occasion to say how I have never regretted that I had no better opportunity of appealing exclusively to the farmers of the State. I don't know that I want to take them on one side to whisper anything. Let him hear that hath ears. I have rather preferred to say what I had to say through a medium of communication that is open to everybody, and let it take its chance. I thought, you know, that the land might be the gainer in the end, if the people who were not farmers had an opportunity of becoming familiar with a farmer's thoughts. We don't want our commonwealth divided into unsympathetic classes, but unless we make an effort to understand each other and excite and nourish an intellectual knowledge of one another we are very liable to have it so. Pure agriculture, like pure pork, or molasses, may be a little too rich for some digestions, while a mixture, a seasoning like, might be quite acceptable. My feeling about farm print is the same as it is about farm bread—half a loaf or half a column is better than none. Some of our very best farm news is given in journals that are chiefly devoted to something else, and there doubtless remain other newspapers, where a corner would willingly be allotted to the garden if not to the farm or household; where a discreet and industrious writer of either sex might be entirely at home. A writer must be at home and at ease as a cow must, you know, to yield anything worth while.

The newspaper, after all, is a very new thing, scarcely introduced as yet and by no means finished. Like woman or man it needs to be loved to do its best. The first corner of a newspaper I ever learned to love, by the way, was occupied by a woman—her name was Lydia Maria Child. She helped train my boyish eyes to see pleasant and beautiful things out of doors.

The influence of the newspaper is often overstated. It does less hurt than some suppose and less good than some suppose. Many of the operations of nature do not require constant newspaper help. If any fellow thinks the daily news indispensable, let him try a sea-voyage or an intellectual fast of a year or two upon a back-country farm. In either case he may find his judgment keeping even pace with the newspaper press.

In 1873 we thought the industrial plants of California were getting more newspaper culture than was really good for them. Two lively dailies were often sparring in one little village. The boy who pulled his beans to see how they grew may have developed into a too ardent and too curious journalist. Our show of paper needs to bear a suitable relation to our show of business. I once knew a hen that got a trick of cackling when she hadn't laid any egg. All her force went to cackle, and she set all the rest of the fowls at it. We didn't continue the experiment long enough to determine results with absolute, scientific accuracy. We couldn't afford to. Farmers never can afford to let any blamed foolishness go on—they always lose by it in the end. Our hen-yard, in cackling-time, became such a theater and circus of make-believe action, with running around and crowing, and flapping of wings, so out of all proportion to the business done there, that we sent that old hen to pot. Smart business men may say that we should have sold out our stock of poultry right in the height of the cackling. Dabsters in science may fear that we nipped a grand social experiment in the bud. Who knows but that old hen may have been a true reformer, one who had found an easier and more popular way of getting a living than the old, "low" and "slavish" system of laying eggs? But the wise farm journalist must wonder, as the farmer does, where the corn is coming from to keep up a festive semblance of business, unless those who furnish the corn discover that all the noise and activity amounts to something.

The self-esteem of the journalist is often rudely shocked by finding that reading is done too much in a hurry to apprehend his finest points. He notices the labors of Mr. Jones favorably, whereupon Messrs. Smith, Brown and Robinson, in the same line of business who have not been mentioned, compliment Jones ironically about his publicity, and make him feel that he has been imposed upon without his ever reading carefully what has been written, and while his own mother couldn't ask a more judicious word for him.

Publishers sometimes aver that farmers in general are close to deal with as the bark of a tree, which is not uncomplimentary or unnatural, considering how they get what they have from the ground as slowly as the roots and bark of trees and plants do, and how many stones they have to turn, sometimes, to find a dollar, and how their risks are always long risks with nothing like what a trader would consider the chance of an adequate profit at the end.

Only the blind lead the blind with sublime confidence! No matter how plumb and level a writer sets up his guide-boards in a newspaper, he often finds them pointing both ways in practice, in spite of him; or appearing to, in the dim vision of some people; and travelers who have but just dropped from the clouds in their ignorance are as apt to go one way as another. The fellows who can't read the farm straight are no great hands at reading the book or newspaper straight. More people with imperfect visions have been trying to make a living on the farm in recent years —perhaps always—than we shall have any idea of till we bring all hands to an occulist. "A nod is as good as a wink to a blind man."

You must pardon my egotism continually, or else, of course, I can't stand here and read. The genuine farm writer, like the genuine farmer, is liberally educated and will give away his craft upon occasion. Now it often happens that writers need to throw in a glimpse of real life between their lines. It supports authority, vastly, gives life to script which would otherwise be a dead letter, and I do it as often as a good humor helps me. Once or twice I took occasion to notice a keen laborer who has been in my employ, and whom I admired and was not a little fond of, while aware that he had, or thought he had, no use for a newspaper. He is a man of substance and landed estate, and although he never reads he is never unaware of what is going on. The first time I did it he reminded me of the fact, with no great liking. The next time, my offence had been done with considerable forethought, and when he came to me in private with true manly dignity and remonstrated, I had to inquire if he had read what I had written? No. So I gave him a printed copy to carry home to his family, and after that nothing more was said. I could see, however, by the quiet lines of his face that the newspaper had found favor in his sight. Between impertinence and the right of eminent domain which we must, sooner or later, allow the truly great newspaper, there is a very broad line, not easily overstepped by the conscientious writer. It will never do for a newspaper man or farmer to stay much above his business.

If the people, by any accident or providence, get headed differently from what their accustomed leaders anticipate, and are rushing that way, the best journalist in the world can't stop them, any more than the best teamster can stop a drove of cattle after they have once got started, with their heads and tails up. Nothing holds, at such times, but previous training in reasonable courses. Mishandled whips are left behind, while new leaders, according to the gravity of the situation, are developed on the scamper, or spry fellows run around the crowd and come in ahead, as the smart teamster or journalist may—with some loss of dignity. The character for these emergencies never springs up suddenly, however it may appear, but grows in absurdly slow annual circles, like the growth of a tree.

In the warm spell following a cold snap in winter, farm cattle will kick up their heels most innocently, and shrewd managers will provide suitable occasions for the recreation. So the masses of our people—leaders and all—in the joy of prosperity after hard times, may be led into extravagances, unless a better judgment provides a reasonable vent or restraint, in view of the harder times and colder weather possibly in store for us.

Finally, as regards the agricultural Press, no prophet is required to see that it must take care of the earth as the foot-stool of goodness to enjoy any great future. It must not conserve this favorite race, or society, or party, or location,—only the entire land and what is best for the land, trusting to the old doctrine of election or the newer one of selection to bring men and their institutions, through love and kindness, under the law and power of righteousness. We can't endure a man or woman around us that is any better than we are, or that knows any more than we do, unless the person is meeker than Moses, but our incompatibility of temper is never so obvious with better books, magazines, or newspapers.

The books and newspapers we buy are ours as much as the beef and bread we buy or grow, provided we are strong enough to work the good of them into our lives.

Mr. HINMAN. I have a resolution that I wish to present to the meeting.

Resolved, That the thanks of this Convention and of the farmers of Connecticut are due to railroads of the State, for favors rendered, not only to the members of this Convention, but to the Board of Agriculture, and the Commission on Diseases of Domestic Animals, throughout the year.

The resolution was adopted.

Mr. AUGUR. You are well aware, as are all who have been in attendance at these meetings, that we have been greatly favored by those gentlemen who have made contributions of fruit, corn, grain, and other articles, which have attracted much attention and awakened a good deal of interest. Therefore, allow me to offer the following resolution:

Resolved, That we tender our hearty thanks to all who have so generously contributed fruits, vegetables, corn, grain, evaporated fruits, jellies, and canned fruits, showing what can be done in growing and preserving fine fruits in our commonwealth. Adopted.

Mr. AUGUR. I have another resolution, in the same line.

Resolved, That the thanks of the Board of Agriculture are tendered to the Guilford Canning Co.; and that we confidently recommend their goods to the public, having tried them, and found them to be of the highest excellence. Adopted.

Dr. BOWEN of Woodstock. We are greatly indebted to the press of the State, which has brought to us daily the proceedings of this Convention, and I therefore beg leave to offer the following resolution:

Resolved, That the thanks of this Convention are due to the press for the dissemination of the knowledge of this meeting, and for the help which they have given us. Adopted.

Mr. STEWART. I hold in my hand a resolution which I wish to present to the Convention:

Resolved, That the thanks of this Convention be tendered to the Farmers' Club, and to the citizens of New Britain, for their courtesies during this series of meetings. Adopted.

Mr. STEWART. I would also present another resolution:

Resolved, That the thanks of this Convention be tendered to Mr. L. S. Wells for his very efficient aid in preparing for, and during the continuance of, this convention. Adopted.

Mr. GOLD. Allow me to present a resolution. We have been permitted to examine some of the industries which have made New Britain so prosperous:

Resolved, That the thanks of the Convention be returned to Messrs. Russell & Erwin for their kind invitation to visit their works, which has been accepted with so much satisfaction. Adopted.

Mr. **Day.** I move that the thanks of this Convention be tendered to Prof. Carleton, the Principal, and the teachers and scholars of the State Normal School, for the very interesting and entertaining exhibitions they have given us. I visited the school, in common with other gentlemen, on the first day, and I certainly think the institution should be the pride of the State. Such an exhibition of learning, of readiness of thought, of mental training, as I saw there, was certainly calculated to make me, and every one who was present, proud of old Connecticut. Any one, in any part of the State, who needs a thoroughly competent teacher, lady or gentleman, would certainly do well to make application to the State Normal School.

The motion of Mr. Day was adopted.

The **Chairman.** The Secretary, who is always full of suggestions, has said that it would be very proper to call upon a gentleman who can have no self-interest in the doings of this convention, being from the great emporium, the "hub of the universe," to say a word—Mr. Whittaker of Boston.

Mr. **Whittaker.** Mr. Chairman,—I was in hopes that I should have been excused to-night, on account of physical disability, but notwithstanding that, I do not know that I could bid farewell to this convention without expressing my thanks to all connected with it for the great ideas that have been promulgated during the three days that we have been together. I do not remember attending any public meeting, at any time, where questions of such vital importance, if not to us, at least to those of the coming generation, have been discussed. We have been trying to take out, if possible, some of the white-birch roots, hardhack, white-oak stubs and boulders that might otherwise be in the way of those who may have to cultivate their minds at the same time that they cultivate the land.

One idea ought to be present with us at all times;—that we do not live for ourselves, however selfish we may be, but we live for posterity; and posterity has claims upon us. What we are, Mr. Chairman, we may expect our children to be. We, the lords of creation, are not exempt from that law which pervades the whole animal kingdom—"like begets like."

Whatever our ideas may be, whatever our desires, whatever our aspirations may be, we, to a certain degree, transmit them to our children. We cannot transmit knowledge, but we can transmit the desire to obtain knowledge. We can educate a dog in such a manner that the offspring of that dog shall follow in the tracks of the dog that we educated. We educate the dog to follow the sheep, and drive the flock, and if we want a dog to do that we go to the offspring of that dog for that purpose. If we want a dog to hunt birds, we go for the pointer and the setter. Gentlemen, are our children of inferior material to the dogs? Will they not readily learn that which we desire to learn?

Mr. Chairman, the great question has been before this convention: What is to be done with the boy and the girl on the farm, and how are they to be best educated for that position? We have talked about carrying agriculture into the schools, of having agricultural schools, and having agricultural colleges, and the great work that has been done to-day has been to sow the seed for that purpose. Now, gentlemen, when we go away from this place are we going to take away with us that seed? Has it fallen upon rich and fertile ground, so that in a short time it shall germinate, grow up, and finally result in some noble structure where the youth who are not born at the present day may enjoy privileges of which we have been deprived?

I think, Mr. Chairman, that this is not exactly a question of dollars and cents with any of us, but that it is a question of the elevation of future generations. I hope and trust that the day is not far distant when it shall not be said that Connecticut is behind Prussia. And permit me to say one word in reference to that. With all due deference to these friends who have drawn the line between what Prussia is doing in educating her sons and daughters, and what Connecticut is doing in the same direction, there was one picture that was not drawn. Not long ago I listened to a gentleman who has travelled there, and he told his audience how the mothers and daughters were toiling on the land, and went on to say that he had seen a man holding a plough with a cow yoked on one side and his wife on the other. That, sir; is the condition not of the higher classes of Prussia, but of the lower classes. The pride of America to-day is, not that she has a few men better educated than either Prussia or Germany, but that the masses of her people are better educated than the people of those countries. That is the glory of the United States of America—a free school to the poorest child in the country. There is where we stand. Now let us go to work and not begin at the top. There are classes in the United States who can take care of their children, and educate them just as they want them educated; but we have a class that cannot do that. They must look to the State, they must look to the country, to see to it that their children are educated. The laborers of the country go to the polls and deposit their votes, and each one of those votes has as much weight as the vote of the greatest and most powerful man in your country; and the State ought to see to it that that vote represents as much intelligence as any other vote. That, Mr. Chairman, is a duty that devolves upon us all, to see to it, as far as in our power lies, that the ballot shall be the representative of intelligence, and not of despotism or superstition.

And now, Mr. Chairman, I bid you farewell, perhaps forever. But remember that wherever you may go, or wherever I may go, that Being who made us all has placed in our care those who cannot care for themselves.

The Convention then adjourned, without day.

REPORT OF THE COMMISSIONERS ON DISEASES OF DOMESTIC ANIMALS.

To the Connecticut Board of Agriculture :

While the past year has not been marked by any serious outbreak of disease among our domestic animals, yet various causes have operated to call into requisition the services of your commission on numerous occasions.

PLEURO-PNEUMONIA,

Though not appearing in an acute form, yet as it was supposed to still linger in certain herds in Fairfield county, and there were some outbreaks in contiguous parts of the state of New York, has required our constant watchfulness, but we are happy to report that in our opinion it has entirely vanished from our state and our only danger is from fresh importations of the malady. The treasury of the state has not been drawn upon to pay for any diseased or exposed cattle, and we hope for like exemption in the future.

Aside from the losses that may accrue to individual farmers from the spread of this disease, its existence in the country threatens great interruption or the entire suspension of our exportation of live stock. Individual states can hardly act with that coöperation necessary for the extinction of this insidious disease; the neglect of one nullifies the action of others as far as our national cattle traffic is concerned; all the states, even those now exempt, have a common interest in the matter, therefore it would seem eminently proper that our national government should take speedy measures to stamp out pleuro-pneumonia by destroying all infected or exposed herds, and by a system of supervision to guard against its renewed importation. We notice with satisfaction that at last the attention of Congress is aroused and we have reason to anticipate speedy and efficient action. We believe that the general government and individual states will eradicate it.

TUBERCULOSIS,

or consumption, appears more frequently than formerly, as it is largely a hereditary disease, and some herds and families are more subject to it than others. Until recently it has not been pronounced as contagious, but the evidence that it is so to some extent is so clear that an animal afflicted with it must be considered not only valueless but dangerous. In some cases the contagion spreads from the lungs or the droppings from the mouth, in others the disease is conveyed by the milk, so that it is unfit for human food or feeding animals. For breeding purposes tuberculous animals are worse than useless, so that whenever the nature of the malady is determined all affected animals should be destroyed. In the present state of our knowledge your commission have never required this to be done at the expense of the state but have left it at the discretion of the individual owners. In the interest of humanity and of self preservation every dairyman should watch his cows, and any that run down without a known cause, may have a cough and bad respiration with a staring coat and general lack of thrift, should be destroyed.

ABORTION IN COWS

continues to visit new localities, sometimes leaving its old haunts and sometimes still prevailing there. We are as far as ever from finding the cause and remedy.

THE LUNG WORM

(*Strongylus filaria*) in calves and lambs, though rarely leading to fatal results, yet is a serious evil as no animal will thrive when thus infested.

Prevention consists in keeping them from infected fields.

Remedies. Cause them to breathe chlorine gas as strong as can be endured by the attendant, or give to lambs of six months a teaspoonful of spirits turpentine, and to calves a tablespoonful in a little water, repeating the dose for a few days.

THE FOULS

has been unusually prevalent in some sections so that some herds have scarcely been exempt at any time.

As it assumes different forms at different times, various modes of treatment are required, but the most important thing is to take care of the general health of the animal. Like felons or boils the fouls usually accompanies some constitutional derangement.

THE HERD OF COWS OF EDWARD WOODFORD and Son of West Avon were reported to us May 5th as mysteriously sick.

May 6th went to see them with Dr. Cressy and found four of them dead, and another died while we were there. The remaining three comprising the entire herd died during the week.

As the symptoms indicated poison, we took part of the stomach and intestines to Prof. Johnson, for examination. He found no direct evidence of poison, but sent for sample of meal upon which the cows had been fed. On examining this, as appears by report of the Experiment Station, oxalic acid was detected in large quantity, and no doubt remains that this was the cause of death. After inquiry by the commission for the possible source whence the poison came, the matter was left in charge of the local authorities, but so far all their efforts to detect the author of the crime have proved unavailing.

DISEASE IN HORSES.

In March an alarming disease broke out in Greenwich among horses, and your commission called upon Prof. James Law of Cornell University, then in New York, to make an investigation. His report here given details the nature of the malady and its treatment.

REPORT OF PROF. JAMES LAW, V. S., ITHACA, N. Y.

INFECTIOUS LUNG DISEASE IN HORSES AT GREENWICH, CONN.

On March 13, 1880, by request of Hon. E. H. Hyde, I accompanied him to Greenwich, Conn., to make enquiry into the cause of sudden deaths of horses that had occurred in that village and neighborhood. We found that the last seriously affected animal, the property of Mr. Brush of Greenwich village, had died the same morning at 2 A. M., but had been preserved for *post mortem* examination. This I proceeded to make at 11 A. M., with the assistance of Dr. L. P. Jones and Dr. Brush, Jr. The following notes were taken:

"*Rigor mortis* well marked. The blood is still in great part in a fluid condition; where clotted the solid mass is of a very dark color, but with a portion straw-yellow or buffed. The inroads made on the vital fluid by the disease are further manifested in the numerous blood extravasations, in some places in the form of minute red spots (petechiæ) which cannot be obliterated by pressure, and in others by distinct blood-clots of a small size in the substance of the tissues, the walls of the blood-vessels having given way and allowed the escape of the liquid contents to coagulate in the surrounding textures."

"The *right lung* is gorged with dark-colored blood, but as the animal had lain on this side since death, the condition is obviously due to gravitation of the blood to the lowest point (hypostatic engorgement)."

"The *left lung* had its anterior part infiltrated with a straw-colored exudation, which is especially abundant in the connective tissue between the ultimate lobules of the lung, and in that binding the lung to its covering (pleura)."

"The lobules themselves, or lung-tissue proper, are mostly of a dark red, almost black color from the over-distention and blocking of its capillary vessels with red bloody globules. The blood-vessels running into such infarcted lobules are also blocked and rendered impervious by firm clots of black blood, extending as far as the lung has become consolidated and blackened, and in some instances a little beyond. The exudation is not, however, confined to the lung tissue and sub-pleural connective tissue, but shows also on the fore surface of the pleura in the form of shreds of false membranes of a straw-yellow color."

"The *throat* is the seat of marked changes, the cellular layer (epithelium) dropping off from the back of the *tongue* and *fauces*, and the *larynx* and *pharynx* presenting numerous slight extravasations of blood (petechiæ and even small blood-clots) in and beneath the mucous membrane."

"The *lining membrane of the abdomen* (peritoneum) is also the seat of recent straw-colored exudation, and friable false membranes hang in loose shreds from its surface. Several groups of the abdominal lymphatic glands (mesenteric) are congested of a deep red, and others almost black."

The nature of these lesions and the implication of widely-distant organs suggest the presence in the system of a pernicious poison acting on the blood and system at large, rather than a simple local inflammation due to exposure or some locally-acting cause. The simultaneous implication of the throat, lungs, bowels, and lymphatic glands finds a near counterpart in the deadly *hog-cholera*, and the parallel is especially close in the widespread blocking of capillary blood-vessels causing petechiæ, and minute blood-clots, and the sanguineous engorgement of the lymphatic glands, the points at which the poison taken up from the affected tissues is especially delayed and propagated. On the other hand, the lesions in the lungs are almost identical with those produced in the *lung plague in cattle*, allowance being made for the wide difference in the anatomical structure of these organs in the two genera. The coagulation of the blood in the blood-vessels going to particular lobules, and the loading of the capillary vessels in these lobules with red globules until they become impervious and the lung-tissue virtually black, is the same in the two animals. Then the straw-colored exudate between the lobules and beneath the pleura, which is so abundant in *lung plague of cattle* and determines the marbling of the affected lung, is rarely seen in the *ordinary inflammation of the lungs in the horse*, but was so extensive in the case before us that different lobules were separated by this straw-colored exudate to the extent of a quarter of an inch, and the pleura was raised from the lung tissue by half an inch and over.

The usual cause of this black hepatisation of the lung and excessive gelatinoid exudate is as follows: From the action of some special irritant, disease begins in the walls of the blood-vessels accompanying the air-tubes. It may be a poison in the blood itself, causing coagulation of that fluid in the vessels, the walls of which thus become inflamed secondarily and throw out an exudation which envelopes and compresses not only the adjacent blood-vessels but also the lymphatics, so that neither blood nor lymph can return freely from the isolated lobules. Blood continues to flow into the capillary blood-vessels of the isolated lobules from the communicating capillaries of the neighboring lobules, but as it cannot readily return the vessels get over-distended, their selective power is lost, and they allow the liquid parts of the blood to ooze through their walls into the loose connective tissue. The blood globules are mostly retained within the vessels, and this process goes on until the rich capillary network of these lobules are filled to repletion with the dark red cells, giving the lung tissue the characteristic black hue. Meanwhile the blood liquids that have oozed through the walls of the vessels can be taken up neither by the veins nor lymphatic vessels, as both are blocked by the swelling at the entrance of the lobules. It therefore accumulates in the loose connective tissue, and forms the straw-colored liquid or soft solid which separates lobule widely from lobule and the pleura from the surface of the lung.

The trouble may start in another way, not from the clots within the vessels causing inflammation of their coats and an effusion which compresses and blocks the adjacent vessels, but on the contrary the walls of the blood-vessels or their sheaths may be the first to be inflamed, in which case the blood coagulates in the vessels as a secondary result and because of its contact with the inflamed walls. But in both cases alike the subsequent course of the affection is the same, the artery leading into the lobule or lobules is blocked by a blood-clot, the adjacent veins and lymphatic vessels are compressed by exudation and rendered impervious, or nearly so, the capillary blood-vessels of the air-cells are blocked by blood globules, and the looser texture of the connective tissue is filled with a yellowish liquid.

What is to be particularly observed is that this form of disease in the lung does not arise on the surface of the air-tubes nor in the air-cells, but in connection with the blood-vessels going to these parts, while the lung tissue proper and epithelial lining of the air-tubes are affected only as a secondary result. It mostly arises, therefore, from some source of irritation in the blood itself or in the liquids thrown out from the blood. In a case like the present, in which the diseased processes were far from being confined to the lungs, there was additional reason for the conclusion that the immediate source of the malady (materies morbi) was to be sought in the blood. In view of this it will not be surprising if the history of the outbreak should give evidence of infection from horse to horse. The following report is obtained from Mr. Brush:

Mr. Brush's sister, who occupies a farm three miles distant from Greenwich village, lost her two horses, with symptoms similar to his own, about the middle of February, 1880. The first to be attacked was driven three miles and became so ill that it was got back with great difficulty. It was not known to have been near any sick horse, and no special sickness was known to exist in the district, though a similar disease had been prevailing very widely in Kentucky and adjacent states months before, and had gradually invaded the eastern cities, having reached its height in Albany, N. Y., early in January.

After this loss Mr. B. gave a team to his sister, but stipulated that they should not be placed in the stable where her own team had died, yet one of the new horses took ill and died about February 21st. The second still remained on the sister's place and was doing well.

In visiting his sister Mr. B. drove a second team, but avoided placing them in any building, having tied them to a hitching post in the road. He also obtained a load of hay from his sister, but not the same that had been used for the horses that died. A week after the arrival of the hay (Sunday March 7th), one of the team he had been accustomed to drive to his sister's place took ill. He chewed his food as if with appetite, but could not swallow.

Mr. B. removed this horse to his son's barn in the village, where he died the same night at 8 P. M. The next victim was a three-year-old colt, which was attacked Wednesday, March 10th, in Mr. B.'s village barn. There was inappetence and running at the nose, but no slobbering, the first day. Thursday it was unable to swallow, passed neither dung or urine, coughed, had colicy pains, and lay down and rose frequently. This animal died Friday morning. The last subject, the object of the *post mortem* examination, was noticed ill on Thursday afternoon, March 11th, but continued to eat until he began slobbering Thursday night. Friday he was paralyzed and unable to rise, and he died Saturday at 2 P. M.

To sum up: The disease began at the sister's place, where three horses died, two of her own and one of Mr. Brush's. It next appeared in Mr. Brush's stable in the village, in a horse that had been driven to his sister's, and this and two others died in rapid succession. There remained, of the animals exposed to infection, one of Mr. B.'s horses still on his sister's farm, an aged horse and filly in his own village barn, and a gelding in his son's village barn, where his first home horse died. Out of ten horses, six had died and four had so far resisted, though three of them had been fed on the hay that had been brought from the infected farm and which had been fed to Mr. Brush's horses that died. This hay had not been given to his sister's horses.

That the malady was propagated by a contagious element cannot be doubted. As to the origin of this germ, it would be the simplest solution to suppose that it had been developed spontaneously in the first sick horses on the farm. This may have been the case, as we cannot but suppose that the germs of any specific disease must have been generated sometime and in some circumstances; and if this has happened once, it may happen again and again. Some recent experiments of Buchner seem to establish that the deadly anthrax of animals (*Bacillus anthracis*) may be developed by continuous generation of the common hay bacterium (*Bacillus subtilis*) grown beneath the surface of an extract of meat. Similarly we all know how the cells of our own skin lose their normal functions and attain abnormal ones when subjected to irritation, and that such changes effected in one cell by a foreign body are propagated from cell to cell for a considerable distance from the seat of injury. Thus, in the case of the prick of a pin, it is not alone the cells that are wounded that undergo rapid multiplication and increase, but those adjacent to them as well; and thus a considerable area of redness, swelling, and tenderness is formed around the minute prick. Here we have the simplest example of infection, and we can easily conceive of more extensive and lasting changes effected in living cells and granules of the body, so that such cells and granules may be passed from body to body, and carry with them their disease-producing powers. In the case of the fungi and microphytes, the occurrence of variation and change is a constant result of cultivation in different fluid under or in new surroundings. The very outbreak of a plague like this lung disease of horses, which is first seen in the center of the continent and slowly spreads in all directions, will strike most minds as, of necessity, the result of a generation *de novo*, as why otherwise did the virus remain so long inactive in Kentucky or Indiana, and when did it arrive there?

But, on the other hand, a long and varied experience has taught the pathologist that such new generations of disease are exceedingly rare occurrences, at the most. Diseases like *small-pox*, *sheep-pox*, *Asiatic cholera*, *plague*, *rinderpest*, *bovine lung plague*, etc., which but a short time ago would have been recognized as arising spontaneously in different parts of the world and at frequent intervals, are now known to be purely exotic in whole continents where they prevail, and to be capable of control, extinction, and exclusion, by measures simply directed to prevent the propagation of contagion. Every day's experience shows more and more clearly that, in the case of communicable diseases, whether of man or animals, the true method of control is to be found in checking their propagation by contagion, and that, if we can succeed in this, the suffering, mortality, and loss from such diseases will be about done away with. In view of the extreme rarity of the *generation* of such diseases *anew*, it is most reasonable to suppose that the first case of this affection that occurred at Greenwich was the result of contagion. With the malady prevalent at Albany, New York, and other eastern cities, it was exceedingly likely that the germs should be conveyed to Greenwich, either by a passing team, in the clothes of persons, in fodder, on the air, or otherwise. That it proved so virulent may be partly owing to the conditions under which the first victims in Greenwich lived, or to some special exposure in inclement weather.

We were here, then, dealing with a malady which was assuredly contagious, and of which the local outbreak was *probably* the result of imported contagion. Its course, therefore, in Greenwich, as compared with other places where it prevailed much more extensively, may serve to point an argument as to the true mode of dealing with such maladies. In Albany, where it was almost universal in January, little was done to check its propagation from horse to horse or from stable to stable. In large livery stables the healthy and sick were found standing side by side, and not even measures of disinfection were being adopted, every effort being devoted to the remedial treatment of the animals that were already attacked. Then the sick and convalescent were exercised or used, as the case may be, in the public streets, allowing every opportunity for the propagation of the poison; so that it is not at all surprising the affection was universal, and that it caused a high mortality.

In Greenwich, on the other hand, the sick were, as far as possible, secluded, disinfectants were freely used in the stables, and the fodder in such stables was fed only to such horses as had recovered or had proved insusceptible to the affection, or to cows. The outbreak at Greenwich was attended by a constant and early mortality, and was apparently highly infectious; yet, with the precautions named and the advantages of country air, it did not appear to spread beyond the two studs first attacked. The following embraces the main suggestions made in the case of the outbreak at Greenwich, and would be applicable in similar circumstances elsewhere:

1st. The diseased should be kept well secluded from the healthy until they have fully recovered from the affection. Not only should they have separate stables, but these should be at a considerable distance (100 to 200 feet) from any building containing other horses.

2d. The infected stables should be freely sprinkled with carbolic acid, and cloths saturated with this agent might be hung up at intervals so as to keep the air constantly charged with its vapor and prevent the preservation and propagation of the disease-germs. The manure should be promptly removed and sprinkled with a strong solution of sulphate of iron (copperas) or chloride of lime. Copperas or finely-powdered gypsum should be freely used in the stables to suppress any disagreeable odors and keep the air sweet. Finally, the air of the stable should be purified thrice daily by burning as much of the flour of sulphur as the patients can breathe without irritation and coughing. This should not be burned under the animals' noses, but behind them, so that it may be well and uniformly diluted with air before it is inhaled, and it should be kept up for at least half an hour on each occasion.

3d. No hay, straw, nor other objects, should be taken from the infected stables to be fed to other horses or used about them. In feeding such to the convalescent or apparently insusceptible, it is a wise precaution, first, to leave it exposed to the air for some time in a loose and open condition, and even to sprinkle it with a weak solution of carbolic acid—one part to one hundred parts water.

4th. Horses in other stables within a considerable area around the infected one should be well cared for as regards the securing of pure air, sound food at regular intervals, pure water, protection against currents of cold air, rain storms, chills when heated, etc., and they should be fumigated by burning sulphur, as above described, at least once every day for half an hour at a time.

5th. The stables of such animals should be as carefully managed, as regards cleanliness and deodorizers, as in the case of those of the sick.

Your commission were called in December to investigate the cause of death in a stable of six mules in Meriden on the farm of the Coe Brothers, which had all died in two days. Dr. Cressy was called to make the examination, and his report of the case is appended.

REPORT OF NOAH CRESSY, M.D., V.S., PH.D.

The condition of Coe's mules at Meriden, that I was called upon to examine, pointed in a most emphatic manner to an acute inflammation of the kidneys, which was brought on from severe exposure to a *cold* draft during the night after working hard all day, and upon a change of feed.

The kidneys were much congested and ruptured, with mucous and pus in the hilum of the organs, thus showing acute inflammation, and in a fatal form.

Six mules were examined, and with nearly uniform results. The liver was congested slightly, the bowels showed little or no signs of disease. The lungs were not involved, light, and floated on water as in health, but darkened by the coloration of blood after death.

There were no indications of poison, as some suggested, and my opinion was confirmed by the investigations of Prof. Johnson.

GLANDERS.

The passage of a special act on this subject by the last General Assembly has imposed new and laborious duties on your commission. In general we have met with little difficulty in our labors. Twenty-six horses in different parts of the state have been condemned as affected with glanders on the authority of veterinarians, and have been promptly destroyed by their owners according to the statute, and perhaps the owners have despatched as many more in view of the probable action of the commission, should they learn the condition of the horses. But the case of the horses of H. S. Merwin of Durham merits special notice, and we give the history in detail.

About the middle of July we were informed that Mr. Merwin had horses suspected of glanders recently brought from Vermont. July 20th, on information from Geo. H. Parkinson, a veterinary practitioner of Middletown, that these horses in his opinion were glandered, we sent notice of quarantine by him to Mr. Merwin, which was delivered July 21st. July 23d, the commission visited the horses with Dr. O'Sullivan, of New Haven, but his report was withheld till Mr. Merwin could also call a veterinarian, and then one horse was pronounced by him as glandered and the symptoms of the other such as "to demand close quarantine."

Thomas Bland, a veterinary practitioner of Waterbury, called by Mr. Merwin, reported to us August 1st that the horses were glandered.

August 4th, we again visited the horses and notified Mr. Merwin that one horse was glandered and called his attention to his duty under the statute, and continued the quarantine of the other horse.

Dr. Tibbals of New Haven also saw the horses and reported to us his opinion that they were glandered.

August 11th, we notified John Marshal, first selectman of Durham, of the condition of the horses, and of the law.

In August, as Mr. Merwin refused to admit that the horses were glandered, and claimed that if glandered they should be appraised and slaughtered by the commission, and paid for by the state, the commission offered him to have the horses appraised and slaughtered, and if found glandered to be his loss, he also paying the veterinary expense, but if not glandered the commission would pay for the horses and expenses. This offer substantially was repeated at other times.

October 1st, Dr. Noah Cressy examined the horses at our call, and reported the existence of glanders as "decidedly doubtful," but says that "under such a doubtful condition they cannot be relieved from quarantine."

October 30th, we again examined the horses, and at this time withdrew the notice that required Mr. Merwin, according to the statute, to slaughter one of the horses, and quarantined them both.

December 1st, Dr. O'Sullivan made a second visit and sustained his previous opinion.

December 4th, we called Dr. Liautard, of the New York Veterinary College, to examine the horses. He reported that inoculation alone would settle the question of the nature of the malady, and with our authority took some of the virus from both horses to New York and inoculated two healthy horses, resulting in the production of glanders and farcy in both horses, and he reports "both horses from which the virus was obtained as being affected with chronic glanders." (Note.—The testimony of the veterinarians, by which the commission have been governed, is given in full with this report.)

The latter part of August Mr. Merwin sent us the opinion of Henry G. Newton, endorsed by other lawyers, that the commission were required to appraise and slaughter the horses if glandered, to be paid for by the state under the general law on contagious diseases of domestic animals.

The opinion of the commission that it was not our duty to appraise and slaughter horses affected with glanders has been sustained by Gov. Andrews and other legal authorities consulted by us. (Note.—This legal opinion is also appended to the report.)

The horses are still living, and the order of quarantine is still in force, no farther action having been taken by the commission. The case has proved a tedious one; we have spared no pains to elicit the truth, and our action has always been controlled by the best veterinary authority, yet tempered with a tender regard for

Mr. Merwin, and not from any doubts of the nature of the malady afflicting the horses.

E. H. HYDE, } Commissioners.
T. S. GOLD,
H. L. STEWART,

REPORT OF GEORGE H. PARKINSON.

NEW YORK CITY, Feb. 8, 1881.

August 4, 1880, in company with Commissioners' Hyde and Stewart, I examined a pair of horses belonging to Henry S. Merwin of Durham, Conn. These horses were quarantined per order Commissioner, July 21, 1880, and I had seen No. 1 previous to this and condemned her for glanders, also warning owner to be cautious or to kill the animal.

No. 1. Sex and color—Mare, dark brown, near hind pastern white with star in forehead. Age—About seven or eight years old. Disease—Glanders. History—This mare was received in exchange for another horse and a quantity of hay from A. E. Austin, liveryman of Meriden, who claimed to have brought the horses from Vermont in the spring. Mr. Merwin called the attention of Austin to the enlarged submaxillary glands and discharge from nose of one horse, but he passed it off (Austin) by saying that it was only a cold and would be all right soon.

Symptoms—About the same as on July 21st. Pulse 48; respirations 32; temperature 100⅞° F.; breathing rather stertorous; also one or two scratches about body which seem to be healing kindly; coat looks pretty well; watery discharge from both nasal cavities, but not profuse, from the fact that the owner had probably wiped and washed nose out. Ulcers to be seen on both sides of septum nasi; both submaxillary glands enlarged, the left being the largest, but there are no nodosities visible. Prognosis unfavorable, and no treatment.

No. 2. Sex and color—Brown, but very much faded; hind pastern white, near fore heel white, the white forming a ring around entire coronet, blaze on face a little inclined to left side. Age and disease—About seven years old; glanders. History—This mare was received in exchange for another horse and a quantity of hay from A. E. Austin, liveryman of Meriden, who claims to have brought the horse from Vermont. This mare is rather thin in flesh, much faded in color, and has had two or three hemorrhages from right nostril since Mr. Merwin bought her. At the last attack they thought she would bleed to death. They called in the village physician, who injected a solution of Tincture Ferri Perchloride into nasal cavities, also a hypodermic injection of Ergotine.

Symptoms—21st July. Discharge from nose, slight enlargement of submaxillary glands, an ulcer in left nasal cavity on lower part of septum nasi.

August 4th. Pulse 44; respiration 24; temperature 100¾° F.; watery discharge from nose; slight enlargement of submaxillary glands and adhered together; in left nasal cavity there are two ulcers on septum nasi near lower extremity; anterior portion of lungs probably more or less affected, some cough on compressing trachea, but no nodosities visible. Prognosis—Unfavorable, and no treatment.

P. S. These examinations were made at owner's farm, one July 21st, the other Aug. 4th. Mr. Merwin has owned these horses about three months, and he is very careful to wash out nose before any one examines them, and they being at grass would have a tendency to keep nose clean. But from what I can ascertain there is a muco-purulent discharge.

Yours, etc., GEO. H. PARKINSON.

REPORT OF DR. W. J. O'SULLIVAN, RECEIVED AUG. 7, 1880.

At the request of the Commissioners, Messrs. Hyde and Stewart, I examined, July 23d, two mares, said to be the property of H. S. Merwin.

Mare No. 1. The first examined being a dark brown mare, white star in forehead and white hind fetlock; this mare exhibited two ulcers on schneiderian mucous membrane (the mucous membrane lining nostrils), and the characteristic muco-purulent discharge, etc., of glanders.

The second mare was a light brown mare; the appearances in this mare were not sufficiently developed to warrant a decided opinion, but were sufficient to demand close quarantine.

W. J. O'SULLIVAN, M. R. C. V. S.

REPORT OF THOMAS BLAND.

WATERBURY, JULY 29, 1880.

MR. E. H. HYDE.

Dear Sir,—By request of Mr. Austin of Meriden, I examined two mares, the property of Mr. H. S. Merwin, of Durham, and the following are the conditions:

Black mare, star on forehead; enlargement of intermaxillary gland on left side, nodosities and ulcers in nasal cavities on same side, discharge from both nostrils and cough. Tubercles may exist in the lungs, as there is undoubtedly a diseased condition of both lungs.

Dark brown mare with white strip on face and white feet, having, I believe, bled from the nose twice. Discharging from both nostrils; not any nodosities or ulcers perceptible in nasal cavities, and no enlargement of intermaxillary glands; pressure on trachea causing painful cough; auscultation revealing a slightly diseased condition of the antero-infero portion of both lungs. Although these conditions may be enough to condemn this mare as being glandered, yet the two most important diagnostic symptoms are absent. Still it is my opinion that both mares are suffering with glanders, one being farther advanced than the other.

Yours truly, THOMAS BLAND.

REPORT OF DR. NOAH CRESSY, RECEIVED JAN. 6, 1881.

HARTFORD, CONN., Nov. 2, 1880.

To the Honorable Board of Cattle Commissioners:

GENTLEMEN,—The condition of Merwin's horses in Durham, that I was called upon by your Chairman, Oct. 1st, to examine for glanders, was decidedly doubtful. The discharge which I saw that day was not characteristic of the disease. In fact there was only a slight discharge and not unlike that seen in distemper or sub-acute form of catarrh.

The submaxillary glands were not *much* enlarged, and were *said* to be improving in some respects, less swollen than formerly, and as *no chancres* could be found upon the nasal membrane, I could not concur in the opinion before expressed by other veterinarians.

These cases are interesting and unique, and nothing but the experiment of an inoculation will satisfy me of the true nature of the malady in question. And this should be resorted to *at once*, for a pathological demonstration. Under such a doubtful condition they cannot be relieved from quarantine, but the real symptoms of glanders are not yet manifest.

Yours very truly, N. CRESSY, M.D., V.S., Ph. D.

REPORT OF DR. LIAUTARD.

NEW YORK, Dec. 27, 1880.

E. H. HYDE, ESQ.

Dear Sir,—On or about the first of this month you requested me to visit in Connecticut a pair of mares, the property of Mr. Merwin, which had been quarantined for some time as being suspected as affected with glanders, and to settle if possible the difference of opinion existing as to their positive condition between several veterinary practitioners, and two veterinary surgeons, Messrs. O'Sullivan and Cressy, and thus to decide as to the following action to be taken by your Commission.

Accordingly on the 4th of said month, in your company, I visited the two mares of Mr. Merwin. After hearing the history of their case and the description of the symptoms they had presented, I proceeded to my examination.

The near mare, about 7 years old, 15 hands 2 inches high, with long tail, fair mane, a star on the forehead, some saddle marks and a low stocking on the near hind leg, was found in good condition, with the maxillary glands slightly swollen, a slight discharge on the left side, and presented on the membrane of the septum nasi three or four superficial abrasions; this same membrane was slightly purplish slate color, and gave a slight rough sensation to the touch; the pulse was normal, the respiration normal, the temperature 101½° F.

The off mare was 8 years old, about 15 hands 2 inches high, with long tail, light mane, a stripe on the left side of the nose, middle-size stockings on both hind legs, a white ring on the near fore foot and a few white hairs on the left side of the chest; also in good condition, with normal pulse and respiration, and a temperature of 101. I found her with the maxillary ganglions quite small, but tender, discharging from both nostrils, the discharge being slight, purulent, but not characteristic of glanders, and having on the mucous membrane of the nose, which was quite injected, numerous epithelial erasions. This mare, I was told, had a profuse attack of epitaxis in July last.

In the presence of the symptoms presented by these two animals, and taking into consideration their previous history, with the report that their condition had considerably improved recently, I could not condemn them as being affected with glanders, but with the condition of the mucous membranes principally, and of the other symptoms, I believe it was justifiable to consider both as suspicious of being affected with the disease. It being important to have the question solved as early as possible, and considering that sometimes this suspicious condition lasts for months, I suggested the propriety of inoculating two animals of the same species with the discharge obtained from both mares. In this you agreed and here in a few words is the result of the experiments.

Having received on two different pieces of glass the discharge, first of the near and then of the off mare, and having obtained two horses apparently free from disease, both were inoculated on the 9th of December, and placed on observation, the septum nasi and the outer surface of the false nostrils being selected as the two best spots for inoculation.

A rabbit was inoculated on the inside of both thighs. This animal was found dead three days after, and at post-mortem it presented a diseased condition of the lymphatics of the legs. Though experiments on rabbits are not always successful, negative results would not have proved the non-contagious condition of a virus; but a positive result here is of much importance.

The two subjects of inoculation did not give the results as early as they generally do in similar cases, as instead of appearing after four or five days, it was only towards the 19th of December, when I was on the point of looking at the result as negative, that they began to show themselves.

On the horse that had received the discharge of the near mare, farcinous cords, buttons, and ulcers on the face manifested themselves, with evident tendency to disease of the lymphatics of the neck; and on the other horse, which had received the discharge of the off mare, ulcerations on the membrane of the nose. As these were slow in their progress, to hasten the development of the symptoms, this same horse was re-inoculated with his own discharge from these ulcerations, and, with it, in three days, symptoms of acute farcy and glanders became evident on both sides of the face. Having thus decided by the positive result of those inoculations, both animals were destroyed.

On examination the head of the first revealed small ulcers on both sides of the nostrils on the posterior part of the septum, lead coloration of the mucous membrane, infiltrations of the lymphatic vessels. The head of the second had also ulcerations, same appearance of the mucous membrane of the nose, and a suppurative collection on the left side in the nasal turbinated bone.

In the presence of the results obtained by the inoculation, of the symptoms manifested, and of the lesions revealed, I am brought to the conclusion to pronounce both mares from which the virus was obtained as being affected with chronic glanders.

Respectfully yours,

A. LIAUTARD, M.D., V.S.

LETTER OF DR. JAMES LAW.

CORNELL UNIVERSITY,
ITHACA, N. Y., Feb. 7, 1881.

HON. E. H. HYDE:

My Dear Sir,—Regarding the cases of glanders: First, I know of no State nor province in which glandered horses killed by State or municipal order are paid for. The rule appears to be to place all such cases on the level with canine madness, and to be destroyed, without indemnity, as dangerous to human life. As to the propriety of paying for such animals a good deal might be said. The principle of withholding compensation when the animals killed had been suffering from an affection that threatens human life, would bring into this list malignant anthrax (bloody murrain), tuberculosis, milk sickness, Asiatic cholera in animals. No one would think of seeking compensation for a *rabid* animal in which death would certainly have occurred at an early date in any case. *Glanders* and *tuberculosis* are not necessarily fatal, but genuine and permanent recoveries are rare, and the apparent recoveries so commonly seen are but a temporary covering up of the poison, to break out again whenever the patient is subjected anew to unhealthy conditions. These, therefore, are especially to be feared, since in these apparently convalescent conditions as liable to propagate a most dangerous affection, through milk and flesh, etc., to man and animals. The recovery from anthrax, on the other hand, is a full and permanent recovery, and insures the patient against any further attack of the same disease, just as does a first attack of small pox, rinderpest, or lung plague. Slaughter for anthrax, rinderpest, or lung plague would, therefore, abstractly give the owner a much better title to indemnity than would compulsory slaughter for glanders or tuberculosis. If we look at the other side of the question, it will doubtless appear that the entire extinction of glanders in a State will be greatly hastened by giving indemnity for the animals killed. If the owner is assured that he can get a reasonable recompense for a diseased horse that is almost doomed to die in any case, that may infect himself or his employees fatally, and that he is liable to a fine for exposing in any public place, he will very naturally turn to the authorities for assistance in place of hiding away the disease. In New York it is illegal to use a glandered horse on the public highways, but the enforcement of the law is nobody's business, hence it is a dead letter, and hundreds of glandered horses are kept constantly at work in New York and Brooklyn. To meet such cases you must either employ a staff of inspectors and subject the whole equine population to examination, or you must encourage the owners to report by the promise of indemnity. For a *speedy stamping out* of the disease, I believe the offer of an indemnity would be a most valuable measure. I do not think the owner has any just claim to indemnity, but I think, as a matter of expediency, indemnity would work well.

2d. The history of your two cases, the manifest symptoms of glanders in the early stages, and the supervention of glanders in the two horses inoculated by Dr. Liautard, give the most irrefragible evidence that this is the disease you are dealing with. Any delay to test the matter further by additional inoculations seems to savor of obstruction, and would appear to be quite uncalled for. Dr. Liautard appeared as no partisan, and declined to give a diagnosis until he had tested the matter by inoculation. Bias is therefore out of the question. He took the only right course to be followed in doubtful cases, as horses with chronic glanders will improve or remain stationary under rest, good feeding, and good air; delay could therefore serve no good end. It would only strengthen the doubts. Inoculation gave the sole means of deciding. The inoculation of two subjects removed the objection that might have arisen to the inoculation of one—that it might have been constitutionally insusceptible to the disease,—and the contracting of the disease by both horses inoculated manifestly settles the question. Yours, very truly,

JAMES LAW, F.R.C.V.S.

LEGAL OPINION OF E. H. HYDE, Jr., AND OTHERS.

Hartford, Ct., Jan. 14, 1881.

To the Commissioners on the Diseases of Domestic Animals:

Gentlemen:—Section 1 of chapter V, page 497, of the Public Acts of 1880, prohibits, under a penalty of fine or imprisonment, or both, the sale or use by any person of any horse or other animal having the disease known as glanders or farcy. Section 2 of the same statute makes it the duty of the owner, or any person having charge of any horse, to cause the same to be killed immediately upon being notified by the State Board of Agriculture or the Commissioners on Diseases of Domestic Animals that such horse is infected with said disease, and provides for the punishment by fine or imprisonment, or both, of any person who shall neglect to comply with the provisions of this section.

Chapter LXXIII, page 534, of the Public Acts of the same year confers upon said board or commissioners the power to cause to be killed, when, in their judgment, the public good shall require it, all animals which, in their judgment, are infected with, or have been exposed to and are liable to communicate to other animals any contagious disease, and further provides for an appraisal of such animals before they can be killed, and for a compensation therefor, based on such appraisal, to be paid to the owner thereof by the state.

The question which you desire to have answered, in view of these statutes, as I understand it, is whether the owner of a horse, who has been duly notified that such horse is infected with the glanders, incurs the penalties prescribed in the 2d section of chapter V, upon his neglect to cause said horse to be killed immediately upon receiving such notification.

I answer the question unhesitatingly and without qualification in the affirmative,—such owner is liable to prosecution and conviction under said section.

The contrary, however, is contended upon the ground that section 2 of chapter V is repealed by implication by chapter LXXIII.

It is true that a prior statute may be repealed by implication by a later statute whose provisions are inconsistent with and repugnant to the first; but courts do not enforce this rule of law except in cases where the necessity for it is imperative, and they are especially reluctant to apply it in respect to statutes passed at the same session of the legislature. If it can be avoided by a reasonable construction, they will not impute to the law-making power the folly of having enacted, almost simultaneously, laws whose provisions are so inconsistent and contradictory that one of them must be declared to be inoperative. Swift, in his digest, lays down the rule as follows: "Later statutes repeal prior contrary statutes. This must be understood when the statutes are expressly contrary or negative words are used; otherwise, if both the statutes can be reconciled, they must stand and have a concurrent operation." This rule of construction has been approved by our courts in numerous cases, and now let us apply it to the case in question. Prior to 1880 the legislature had created the State Board of Agriculture, and, for the purpose of preventing the spread of contagious diseases among domestic animals, had invested it with power to prohibit the introduction of such animals into this state, and when such diseases existed in this state to quarantine all infected or suspected animals, and to make all investigations and regulations necessary for the prevention, treatment, cure, and extirpation of such disease, and had further provided for the punishment, by a fine of not more than five hundred dollars, of any person who should fail to comply with such regulations.

In this state of the law, the legislature saw fit to direct its attention to the specific disease of glanders, apparently considering it to be of such a dangerous character as to require a distinct and separate enactment for its extirpation. It was not thought sufficient to leave the control of this disease in the hands of the Board of Agriculture, and the legislature therefore dealt with it directly, and called into use for its suppression the machinery of the criminal law of the state. It constitutes the acts of commission and omission specified in chapter V, Offences against the Sovereignty of the State. It not only, by direct enactment and under suitable penalties, established a quarantine in respect to all animals infected with this disease, but especially directed its power against horses thus infected on account of their greater liability to spread the contagion, by commanding their owners to cause their immediate destruction. It will be observed that this statute is not an act in relation to the Board of Agriculture; it neither confers additional power nor imposes new duties upon the board. Its commands are directly to the citizen. It merely selects the Board of Agriculture, as it might have chosen any other agent, as the tribunal to determine a fact, and then charges the citizen, upon being duly notified of the existence of such fact, with the performance of a certain duty to the state.

The legislature, having thus dealt with the glanders, saw fit, at the same session, to enlarge the powers of the Board of Agriculture for the purpose of enabling it to encounter more successfully the evils attending the spread of contagious diseases in general among domestic animals, and therefore passed the act entitled " An act conferring upon the State Board of Agriculture power to kill diseased animals."

This act is not criminal in its nature, it imposes no new duty upon the citizen; it merely gives to the Board of Agriculture a discretionary power when, in their judgment, the public good shall require it, to kill not only animals that are actually infected with, but also those which have been exposed to and are liable to communicate to other animals any contagious disease.

Is there anything in this act to relieve the citizen from the obligation imposed upon him, for the public good, by the 3d section of chapter V?

Has the legislature, in passing a general law giving to its Board of Agriculture a discretionary power to kill certain animals, annulled its positive edict that all animals infected with a particular disease shall be instantly slaughtered?

I think not. These statutes, to my mind, are not only not inconsistent, but in strict harmony, each working by its own methods to accomplish its particular object. The purposes sought to be effected by its two statutes are different, that of the one being the extirpation of a particular disease at all hazards, and that of the other the control, treatment, cure, and extirpation of contagious diseases in general, under the discretion and supervision of the Board of Agriculture. The methods adopted to carry into effect the intention of the legislature are entirely dissimilar. The former statute, applying only to horses infected with the glanders, enforces its provisions by the aid of the criminal law; the latter operating upon all animals infected with or suspected of contagion, invests one of the branches of the civil service of the state with discretionary powers as to its administration.

The state, in effect, by the enactment of chapter V, declared the act of keeping a horse known to be infected with the glanders to be a crime; and I fail to find in any subsequent act any intention on the part of the legislature to annul or modify the force of that declaration.

I will further remark, that not only were these statutes enacted by the same legislature, but they emanated from the same committee and were under consideration at the same time.

No case can be found in which it has been held that a statute of a criminal nature was repealed by implication by a subsequent statute of a civil nature, merely because both might apply to the same subject matter. The legislature may adopt as many methods as it sees fit to remedy a given evil, and, so long as they are not inconsistent and do not conflict with each other, all will be upheld and allowed to have a concurrent operation.

In conclusion, I repeat that, in my judgment, the claim that chapter LXXIII repeals, by implication, section 2 of chapter V is unsound, untenable, and wholly without foundation in law.

Respectfully yours,

E. H. Hyde, Jr.

I concur in this opinion,

Charles B. Andrews.

I concur in the foregoing opinion,

T. E. Doolittle.

I also concur in the foregoing opinion,

A. P. Hyde,
of Waldo, Hubbard & Hyde.
Henry C. Robinson.
S. E. Dunham.

REPORT OF P. M. AUGUR, POMOLOGIST.

The year 1880, like that of 1874, has been one of enormous productiveness as regards the apple; the pear has been less productive; the peach and the plum have yielded fair crops where they have had judicious care; the quince has borne abundantly; the Concord, Hartford Prolific, Ives, Champion, and Worden grapes have borne heavily where they have had the requisite care, and the other varieties have succeeded in a measure or not at all in proportion to the skill or negligence which they have met; and the small fruits have generally offered abundant crops.

The year past must indeed be pronounced a fruitful one, and the blessing has been so great that with the apple, with our imperfect method of handling, there has been hardly room to receive it.

Our Markets.

It is hardly to be denied that as regards our local markets there has been an over production of apples. New York City on one side and Boston on the other, have taken large quantities; all our own towns have been large consumers, every manufacturing village has used largely, and the amount of fruit consumed has been enormous, but still demand has not been commensurate with the supply; exportation to foreign ports has been active, hundreds of thousands of barrels have gone abroad at quite moderate prices, so as to greatly stimulate foreign trade; the drying and canning processes have been prosecuted; also the making of cider and other jellies has been successfully practiced to a small extent, but in spite of all effort, a considerable quantity of our great fruit crop had to be fed to domestic animals, be made into cider and vinegar, or, as was often the case, went to waste altogether. This is a truthful summing up of the general result of our production, sale, and disposition of the fruit crop of the year A. D. 1880.

The question at once arises, in view of such a full fruit crop, what shall the orchardist do? Shall he cut down or neglect his orchard? By no means do either; men often say: "When my orchard bears, there is no market and when there is a market I have no fruit." This moreover is only partly true. Still the question of demand and supply must be considered.

The True Policy of the Orchardist.

1st. He should give his orchard the best possible cultivation and management; aim not so much to produce the most but the best fruit. When a glut in the fruit market occurs, it is the inferior fruit that suffers most in price, therefore produce the best. Again we should carefully study the markets, and raise those fruits that are most called for.

The amateur may plant his hundred and one varieties, adding every novelty as it is offered, but this is to please, not to profit.

For market, a succession of only what the market calls quickly for, is what you need, therefore if you desire pecuniary success change your unprofitable varieties at once by regrafting. A young orchard can be easily changed into just what you desire in this way, and the earlier the better. But with orchards of the best market varieties, what shall the country do with an extraordinary crop like that of 1874 and 1880?

In view of past experience let every effort be made in the future to have the crops of fruit of the very best quality.

Then, 1st. Let every community of orchardists, or orchards of sufficient size, have a capacious, well planned, well constructed, refrigerating fruit house. An ice company may be formed with the double purpose of furnishing a village with ice, and having a good dry lower story for fruit; with this in effective operation all the fruits may be held a reasonable time for market, whereby in many cases much higher prices may be obtained; only choice fruits should be so kept.

2d. As a means of saving fallen or second rate fruit, or any fruit which is liable to be lost from a glut in the market, a similar company should be formed to preserve by canning, evaporating, or by jelly-making all fruit not duly called for at paying prices in the fresh state. With such an arrangement all fruit of reasonably good quality can be saved, not only to the grower but for the world's use, and much that is now necessarily lost might add greatly to the public good, and the producers'.

The General use of Fruit by the People.

An idea often prevails that fruits are of questionable value as an article of food ; and it is sometimes thought that dyspeptics should not use fruits, and that for healthy persons they should be used with extraordinary care, and at special times. The maxim that "fruit is gold in the morning, silver at noon, and lead at night," has many believers who interpret it thus, very good used sparingly in the morning, questionable at noon, and positively bad at evenning. We believe this idea to be pernicious and unsustained by reason. The apple and grape stand at the head of our fruits, both as to capacity for production and in their great value as food for man. And should the people adopt the better varieties of both, and use ten-fold the quantity they have ever dared to use, the public health would improve, longevity be increased, and many diseases yield more easily to medical treatment than now. Our own personal experience in using very freely all the cultivated fruits leads us to believe that when fully ripe they may be eaten with impunity at all hours when any food may properly be allowed, and when cooked they may be used by invalids and convalescents with positive benefit ; also in the sick-room the well-ripened peach, pear, strawberry, or grape may come as a good medicine to the sufferer.

Special Practices of Great Importance in Orchards.

1st. *Culture.* In far too many cases young trees are planted out and left "to take their chances." When trees are planted here and there about some yard or lawn, where general culture cannot conveniently be given, special attention should be allowed to them. Suppose that they have been carefully and well planted out and mulched, they should have that mulch carefully turned back, and the ground about those trees thoroughly mellowed by a prong hoe or potato-hook, for a space of three or four feet radius around each tree, at least four times during the first season, each time replacing the mulch as it was at first; the fine tilth secured, and the consequent æration of the soil, furnish the best conditions for the rapid formation of roots, and the complete establishment of the tree. This operation, so important the first year, can be profitably followed for successive seasons.

Where trees are planted in orchards mulching is desirable, and in hoeing the cultivated crop in such orchards always give each tree in the row special hoeing. A general mulching and the most careful culture accomplish wonders in a newly-planted orchard.

2d. *Pruning.* There is no work incident to a young orchard so often overlooked as pruning; I have seen many cases during the past year where the best culture was given, but the pruning wholly neglected. The true plan is, when planting to reduce the top of the tree by taking out all but four or five branches of the head, leaving but one upward leader, and each year afterward cut out all branches tending inward, and such lateral branches as will, if left to grow, finally interfere with each other. A fork either in the main trunk or elsewhere should be abated by cutting away one branch. Young trees rarely are pruned out enough, old ones consequently need heavy pruning, which is very damaging.

3d. *Washing.* Here is a point where there is some diversity of opinion among intelligent fruit-growers, still we deem it important.

For a pear orchard, where we desire to avoid the scale insect, moss, fire blight, or any other fungoid trouble, we advise the following wash—nine parts quick-lime, and one sulphur, slack with hot water; while hot, add a pint of carbolic soap (soft potash soap with two great spoonfuls carbolic acid incorporated to the pint). The above well mixed and applied to the trunk and branches of the trees we consider a healthful wash, and the best preventive of blight we know of. The same wash applied to the trunk of apple, peach, and quince trees in May, may be regarded as a preventive of the attacks of the borer, if not already in the tree (in which case dig them out). This application containing so much soap gradually washes off, leaving the tree smooth and clean, and the ingredients as they enter the soil have an excellent effect upon the tree.

New Fruits.

Among the many new varieties of Strawberries just offered to the public, those promising best probably are the Bidwell, Mt. Vernon, Kirkwood, and the Gipsy ; many more new varieties will soon be offered.

Among Raspberries (black cap) Skowhegan as early, and the Gregg later, are successful; and among the suckering varieties, Cuthbert, the best, Turner, hardiest.

Among the blackberries the Taylor probably combines most good qualities, while the Snyder is hardiest.

Newer Grapes.

The Prentiss, a new white grape, is productive and excellent—results can only be told by actual trial; same can be said of Lady Washington, Pocklington, Duchesse, El Dorado, Niagara, and Hayes. Among the Red grapes, the Jefferson and Wyoming Red are new candidates worthy of trial. Among the Black, Moore's Early, Cottage, Worden, Cambridge, Early Dawn, and Telegraph promise well.

New Peaches.—The Mrs. Bretts and Wheatland, are both promising and worthy of trial, especially the last.

The list of apples and pears which succeed well is so large and satisfactory that we have no lack of good varieties in succession through their entire season.

WINTER EXHIBIT OF FRUITS AND GRAINS AT NEW BRITAIN.

The collection of fruit, grain, and other articles, was unusually large and fine, and comprised as follows :

A large collection embracing a great variety of Apples, also Pears and Quinces from T. S. Gold, Secretary, from West Cornwall ; also choice collection of apples from H. L. Stewart, of Middle Haddam; J. M. Hubbard of Middletown, which he brought from Waubonsee, Kansas. J. Jackson, E. Wilton; E. F. Blake, New Britain ; H. Bushnell, Berlin; Dea. David Williams, East Hartford ; P. M. Augur, Middlefield ; Middlefield Farmers' Club ; Wm. Alfred, Farmington ; Elias Wilbur, Mystic Bridge; F. Roys, Berlin; R. J. Clark, Berlin ; E. H. Barber, South Side farm, Colebrook ; C. M. Alling, Kensington ; Gad Norton, Bristol ; S. R. Gridley, Bristol ; Bell-Flowers, Albert Day, Brooklyn ; nice apple jelly from a Company in Cheshire ; and J. C. Ellsworth, Windsor, canned tomatoes. Squash, Lima-beans, quince, and a variety of jellies from the Guilford Canning Company.

Evaporated apples from E. L. Johnson & Sons, Newtown; samples of Sorghum Syrup from T. S. Gold, West Cornwall; S. H. Cowles, Norfolk ; J. C. Ellsworth, Windsor ; L. F. Mellen, West Springfield, Mass ; J. H. Dickerman, Mt. Carmel; canned strawberries from G. H. & J. H. Hale, South Glastonbury.

Ensilage from B. C. Platt, Suffield ; Mr. Hurd, Bristol, Ct.

A specially attractive feature of the exhibit was the Grape.

The Niagara, from the Niagara Grape Company, by Secretary Woodward of Lockport, N. Y. The Prentiss Grape from T. S. Hubbard of Fredonia, N. Y ; both white grapes of excellent quality, and the Vergennes, a red grape of good quality, and an excellent keeper from Lindsley and Co., of Bridgeport.

A collection of oats and early Lima beans, a distinct variety, Levi S. Wells, New Britain; Lima beans, J. C. Ellsworth, Windsor; a collection of several varieties of corn, J. H. Dickerman, Mt. Carmel; brindle corn, Sherman Kimberly, Goshen; dent corn, J. M. Hubbard, Middletown; also Waushakum corn. Several very choice varieties from Morgan Pierson and others, Clinton; fine varieties from Messrs. Bartholomew, Benton, Spencer, Hubbard, and others, Guilford; onions, Green's Farms; eight rowed white corn from Austin Jennings, Green's Farms; Ohio yellow dent from T. B. Wakeman, Green's Farms; yellow dent, J. Sherwood, Green's Farms; corn from H. Moore, New Britain; dent corn from E. Davis, Hamden; Ayers corn from E. E. Ayers; choice specimens of large dent corn from Dr. R. P. Greenleaf, New Castle, Del. One hundred day golden dent, E. L. Johnson, Newtown; corn from Mr. Bartholomew, Bristol; T. S. Gold, West Cornwall; early dent corn, J. J. Webb, Hamden; Waushakum corn, H. L. Stewart, Middle Haddam; white flint from Captain Johnson; evergreen sweet corn and pop corn, Dr. A. B. Worthington; long eight rowed field corn, Edward Price, Bridgeport; farmers favorite, M. Pierson, Clinton; yellow and white, eight rowed corn, George Fairchild, Green's Farms; several varieties field and sweet corn from E. L. Blake, New Britain; Ellsworth mammoth corn from D. J. Ellsworth, Windsor; corn from W. S. & H. E. Savage, East Berlin, Charles Hubbard, D. H. Birdsey, H. W. Hurlbut, A. R. Tucker, F. B. Coe, Ichabod Miller, Thomas Vent, P. M. Augur, Middlefield; C. Andrews, New Britain;

Mediterranean wheat from H. W. Hurlbut, Middlefield; wheat from W. Foote, Guilford; butternuts and walnuts from Cyrus Coe, Middlefield. There was also a dish of new Plymouth County early potatoes, and two baskets of turnips from J. J. Webb, of Hamden; from Henry E. Wilcox, Middlefield, Early Vermont potatoes, and a fine dish of Clark's No. 1 potato. From one and a quarter bushels of seed, Mr. Wilcox produced fifty-eight bushels of choice handsome potatoes, and three bushels of small ones. The members of the board and guests tried these potatoes at the hotel table and found the quality very good; they also tried tomatoes and canned fruit from the Guilford Canning Company, and found the quality excellent, also evaporated apples from the American fruit dryer of P. M. Augur, and found the quality excellent. A vote of thanks was passed to all the contributors of fruits, corn, grains, roots and other things, when the audience tested the fruits and cleared the tables. Specimens of varieties of corn on exhibition were selected by Prof. Beal, Dr. Sturtevant and others, who took them as samples of Connecticut products, and a goodly collection was forwarded to the State House, Hartford, for the Agricultural Museum. On the whole, the exhibit was a grand success, and as the board meets with the farmers from year to year this feature of the meetings will doubtless continue to be one of much interest to all who may attend. Let the farmers think of this and let those who win prizes at the fairs show their prize corn, grain, and fruits at the winter meetings of the board.

Our inquiries as to the nutrient and medicinal value of fruits have elicited replies from Dr. A. M. Shew of Hospital for the Insane, Dr. T. D. Crothers, Walnut Hill Asylum for Inebriates, and Dr. H. E. Way of Bristol.

They all unite in giving a high value to fruits as articles of diet for persons in health, and as remedial agents in certain classes of disease, yet in some cases to be avoided or used with caution. They have been found particularly valuable in the treatment of inebriates.

CIDER JELLY.

The past year's experience shows that the making of sweet cider into jelly is a practical thing to do, and is also easily and quickly done.

The method is simply to take good sound mature apples, not over-ripe, grind in an old-fashioned mash-mill, (which is better for *jelly-making* than a *grater*,) press soon after grinding, and evaporate at once, certainly within four hours, in a copper evaporator. Half the apples sweet, and half sub-acid make the choicest jelly; and a barrel of cider will make eight 5½ lb. pails of solid jelly.

Cook's copper evaporator will easily convert eight to twelve barrels of cider per day into jelly. So we see that when we have a surplus crop of apples in a neighborhood, a single evaporator will convert several thousand bushels of apples into jelly, and work on sorghum also.

LETTER FROM DAVID J. ELLSWORTH, WINDSOR.

To the question, how shall we utilize a great crop of apples, such as we found on our hands last fall, and especially those only fit for cider, I think has found a satisfactory and profitable answer, in a product which, for desirableness and ready sale, surpasses all other forms, into which a surplus of cider apples can be reduced. Converted into jelly, in an evaporating pan, to a density of 30 and 32° Baumè, I have found an article for the table which gains rapidly in favor, and when once it has become known and used, will always be in demand. The process of making is very simple, but requires a good copper evaporating pan, such as is used in making cane syrup. Also a hydrometer and test cup to test density, at any time instantly. The syrup should be put into the vessels designed for it very soon, as it will begin to "set" soon after drawn from the pan. The quality of the jelly will depend upon the soundness of the apples, and the neatness of making and handling the cider. The proportion in reduction is 7 to 1, or about 45 lbs. of jelly to 1 barrel cider (32 gallons).

For transportation and rough handling, it should be concentrated to a greater density, but for local and home use, a density of 32° is much better for the table.

EVAPORATING FRUITS.

Our own estimate of drying fruits in the modern way is this; that from 12 to 20 cts. per bushel will prepare the fruits, dry and pack them if due economy of time and fuel is observed. The better way is to have a company to do it on a large scale, and sell the fruits to them at a stipulated price, they making a specialty of the work and doing it in the best and most efficient way.

Still a large fruit farm may use an evaporator perhaps to advantage. The American Fruit Dryer answers its purpose, does good work, but I question whether a larger might not be better. The Williams dryer, and the Alden, have excellent reputations, and for a large business, are probably more economical, and suitable.

Letter from M. W. Terrill, Middlefield.

My experience with the American Fruit Dryer is satisfactory as to quality of work done, but I did not succeed in drying as much fruit as the manufacturers said could be done, viz., eight to ten bushels per day. With mature fruit I succeeded in getting only about six bushels dry in nine to ten hours. Then great care is needed to save fruit from over-heating, and becoming brown. I have made as fine goods as any I have seen in the markets.

THE AGRICULTURE OF CONNECTICUT AND FACILITIES FOR ITS DEVELOPMENT.

POPULATION OF CONNECTICUT BY TOWNS AND COUNTIES 1870 AND 1880.

HARTFORD COUNTY.

	1880.	1870.	Gain.	Loss.
Hartford	42,569	37,743	4,826	....
Avon	1,057	987	70	....
Berlin	2,385	2,436	....	51
Bloomfield	1,346	1,473	....	127
Bristol	5,351	3,788	1,563	....
Burlington	1,224	1,319	....	95
Canton	2,299	2,639	....	340
East Granby	754	853	....	99
East Hartford	3,500	3,007	493	....
East Windsor	3,019	2,882	137	....
Enfield	6,756	6,322	434	....
Farmington	3,014	2,616	398	....
Glastonbury	3,580	3,560	20	....
Granby	1,340	1,517	....	177
Hartland	643	789	....	146
Manchester	6,468	4,223	2,245	....
Marlborough	392	476	....	84
New Britain	13,978	9,480	4,498	....
Newington	934	*	934	....
Plainville	1,930	1,433	497	....
Rocky Hill	1,108	971	137	....
Simsbury	1,833	2,051	....	218
Southington	5,410	4,314	1,096	....
South Windsor	1,902	1,688	214	....
Suffield	3,225	3,277	....	52
West Hartford	1,829	1,533	296	....
Wethersfield	2,173	2,693	....	†520
Windsor	3,056	2,783	273	....
Windsor Locks	2,331	2,154	177	....
Total	125,406	109,007	18,308	1,909

* Counted as a part of Wethersfield in 1870.

† Newington since set off. Wethersfield has really made a *gain* of 200.

Net gain in the county 16,399.

NEW HAVEN COUNTY.

	1880.	1870.	Gain.	Loss.
Bethany	637	1,135	....	498
Beacon Falls	379	*	379	....
Branford	3,047	2,488	559	....
Cheshire	2,284	2,344	....	60
Derby	11,652	8,020	3,632	....
East Haven	3,057	2,714	343	....
Guilford	2,785	2,576	209	....
Hamden	3,410	3,028	382	....
Madison	1,670	1,814	....	144
Meriden	18,130	10,495	7,635	....
Middlebury	688	696	....	8
Milford	3,346	3,405	....	59
Naugatuck	4,281	2,830	1,451	....
New Haven	62,861	50,840	12,021	....
North Branford	1,025	1,035	....	10
North Haven	1,763	1,771	....	8
Orange	3,341	2,634	707	....
Oxford	1,120	1,338	....	218
Prospect	483	551	....	68
Seymour	2,318	2,122	196	....
Southbury	1,740	1,318	422	....
Wallingford	4,688	3,676	1,012	....
Waterbury	23,019	13,106	9,913	....
Wolcott	493	491	2	....
Woodbridge	830	830	....	....
Total	159,247	121,257	38,863	873

*Incorporated in 1871.
Net gain in county, 37,990.

NEW LONDON COUNTY.

	1880.	1870.	Gain.	Loss.
New London	11,136	9,576	1,560	....
Norwich	21,145	16,653	4,492	....
Bozrah	1,155	984	171	....
Colchester	2,974	3,383	....	409
East Lyme	1,731	1,506	225	....
Franklin	686	731	....	45
Griswold	2,745	2,575	170	....
Groton	5,130	5,124	6	....
Lebanon	1,845	2,211	....	366
Ledyard	1,373	1,392	....	19
Lisbon	630	502	128	....
Lyme	1,025	1,181	....	156
Montville	2,666	2,495	171	....
North Stonington	1,769	1,759	10	....
Old Lyme	1,387	1,362	25	....
Preston	2,520	2,161	359	....
Salem	575	717	....	142
Sprague	3,207	3,463	....	256
Stonington	7,353	6,313	1,040	....
Waterford	2,702	2,482	220	....
Totals	73,754	66,570	8,577	1,393

Net gain for the county, 7,184.

FAIRFIELD COUNTY.

	1880.	1870.	Gain.	Loss.
Bethel	2,726	2,311	415	....
Bridgeport	29,153	19,835	9,318	....
Brookfield	1,151	1,193	....	42
Danbury	11,619	8,753	2,866	....
Darien	1,902	1,808	94	....
Easton	1,145	1,288	....	143
Fairfield	3,748	5,645	....	1,897
Greenwich	7,956	7,644	312	....
Huntington	2,504	1,527	977	....
Monroe	1,157	1,226	....	69
New Canaan	2,674	2,497	177	....
New Fairfield	791	870	....	79
Newton	4,013	3,681	332	....
Norwalk	13,960	12,119	1,841	....
Redding	1,540	1,624	....	84
Ridgefield	2,028	1,919	109	....
Sherman	828	846	....	18
Stamford	11,417	9,714	1,703	....
Stratford	4,251	3,022	1,229	....
Trumbull	1,323	1,335	....	12
Weston	918.	1,054	....	136
Westport	3,477	3,361	116	....
Wilton	1,864	1,994	....	130
Totals	112,155	95,276	19,489	2,610

Net gain for the county, 16,879.

WINDHAM COUNTY.

	1880.	1870.	Gain.	Loss.
Windham	8,265	5,412	2,853	....
Ashford	1,041	1,241	....	200
Brooklyn	2,308	2,354	....	46
Canterbury	1,272	1,543	....	271
Chaplin	627	704	....	77
Eastford	855	984	....	129
Hampton	827	891	....	64
Killingly	6,921	5,712	1,209	....
Plainfield	4,023	4,521	....	498
Pomfret	1,470	1,488	....	18
Putnam	5,828	4,192	1,636	....
Scotland	540	643	....	103
Sterling	958	1,022	....	64
Thompson	5,054	3,804	1,250	....
Voluntown	1,186	1,052	134	....
Woodstock	2,638	2,955	....	317
Totals	43,813	38,518	7,082	1,787

Net gain for the county, 5,295.

LITCHFIELD COUNTY.

	1880.	1870.	Gain.	Loss.
Barkhamsted	1,300	1,439	....	139
Bethlehem	656	750	....	94
Bridgewater	708	877	....	169
Canaan	1,157	1,257	....	100
Cornwall	1,584	1,772	....	187
Colebrook	1,148	1,141	7	....
Goshen	1,093	1,223	....	130
Harwinton	1,016	1,044	....	28
Kent	1,622	1,744	....	122
Litchfield	3,410	3,113	297	....
Morris	627	701	....	74
Norfolk	1,418	1,641	....	223
North Canaan	1,537	1,695	....	158
New Milford	3,906	3,586	320	....
New Hartford	3,312	3,078	234	....
Roxbury	950	919	31	....
Salisbury	3,716	3,303	413	....
Sharon	2,580	2,441	139	....
Torrington	3,327	2,893	434	....
Thompson, Plymouth,	3,226 2,351	4,149	1,428	....
Watertown	1,897	1,698	199	....
Washington	1,593	1,563	30	....
Woodbury	2,152	1,931	221	....
Winchester	5,085	4,096	989	....
Warren	639	673	....	34
Totals	52,011	48,727	4,742	1,458

Net gain for the county, 3,284.

MIDDLESEX COUNTY.

	1880.	1870.	Gain.	Loss.
Middletown	11,704	11,126	578	....
Haddam	2,421	2,071	350	....
Chatham	1,966	2,771	....	805
Chester	1,177	1,094	83	....
Clinton	1,412	1,404	8	....
Cromwell	1,640	1,856	....	216
Durham	990	1,086	....	96
East Haddam	3,034	2,951	83	....
Essex	1,858	1,669	189	....
Killingworth	748	856	....	108
Middlefield	928	1,053	....	125
Old Saybrook	1,305	1,215	90	....
Portland	4,162	4,693	....	531
Saybrook	1,363	1,267	96	....
Westbrook	878	987	....	109
Total	35,586	36,099	1,477	1,990

Net loss for the county, 513.

TOLLAND COUNTY.

	1880.	1870.	Gain.	Loss.
Tolland	1,170	1,216	....	46
Andover	429	461	....	32
Bolton	512	576	....	64
Columbia	757	891	....	134
Coventry	2,044	2,057	....	13
Ellington	1,568	1,452	116	....
Hebron	1,243	1,279	....	36
Mansfield	2,155	2,401	....	246
Somers	1,242	1,247	....	5
Stafford	4,454	3,405	1,049	....
Union	539	627	....	88
Vernon	6,916	5,466	1,470	....
Willington	1,086	942	144	....
Totals	24,115	22,000	2,779	664

Net gain for the county, 2,115.

RECAPITULATION.

Counties.	1880.	1870.	Gain.	Loss.
Hartford	**125,406**	**109,007**	**18,308**	**1,909**
New Haven	**159,247**	**121,257**	**38,863**	**873**
New London	**73,754**	**66,570**	**8,577**	**1,393**
Fairfield	**112,155**	**95,276**	**19,489**	**2,610**
Windham	**43,813**	**38,518**	**7,082**	**1,787**
Litchfield	**52,011**	**48,727**	**4,742**	**1,458**
Middlesex	**35,586**	**36,099**	**1,477**	**1,990**
Tolland	**24,115**	**22,000**	**2,779**	**664**
Totals	**626,087**	**537,454**	**101,317**	**12,684**

Net gain for **the state, 88,633.**

PRODUCTIONS OF AGRICULTURE.

COUNTIES.	TOBACCO.			BARLEY.			BUCKWHEAT.			INDIAN CORN.		
	Acres.	Pounds.	Pounds.	Acres.	Bushels.	Bushels.	Acres.	Bushels.	Bushels.	Acres.	Bushels.	Bushels.
		1880.	1870.		1880.	1870.		1880.	1870.		1880.	1870.
Total.........	8,663	14,158,352	8,328,798	576	12,295	26,458	11,317	137,486	148,155	58,135	1,902,504	1,570,364
Fairfield............	802	973,933	190,047	23	444	727	1,277	16,580	21,843	10,046	355,363	285,683
Hartford............	5,112	9,159,514	5,830,209	9	128	388	1,914	20,447	17,203	11,608	340,125	217,502
Litchfield...........	1,586	2,211,151	1,048,569	155	2,940	1,909	2,284	30,128	17,561	8,709	299,494	236,900
Middlesex...........	573	906,753	609,217	6	149	478	547	7,691	7,731	2,677	112,615	85,451
New Haven..........	164	208,895	103,562	61	1,348	7,726	1,052	13,609	17,039	5,898	249,305	234,331
New London.........	19	29,622	10,000	103	1,996	5,590	1,155	12,181	17,546	9,544	246,307	247,362
Tolland.............	405	666,634	531,399	35	803	1,888	1,232	15,915	17,123	3,878	117,470	101,721
Windham...........	2	1,850	5,685	184	4,487	7,752	1,856	20,935	22,109	5,775	181,823	161,414

COUNTIES.	OATS.			RYE.			WHEAT.		
	Acres.	Bushels.	Bushels.	Acres.	Bushels.	Bushels.	Acres.	Bushels.	Bushels.
		1880.	1870.		1880.	1870.		1880.	1870.
Total.........	39,529	1,002,386	1,114,595	29,775	369,309	289,057	2,187	38,526	38,144
Fairfield............	6,926	180,919	172,482	4,964	64,233	46,457	711	13,128	13,312
Hartford............	3,556	83,261	119,335	7,620	86,578	69,387	271	5,233	6,458
Litchfield...........	9,350	281,028	257,606	5,128	58,200	50,444	536	6,580	6,822
Middlesex...........	1,131	30,634	40,352	1,722	30,743	17,101	355	7,734	5,851
New Haven..........	2,925	76,144	106,372	4,905	78,256	56,868	259	4,659	4,357
New London.........	8,148	152,995	174,300	1,410	15,586	16,846	23	430	3,264
Tolland.............	2,277	55,562	76,574	2,126	18,434	15,860	27	542	879
Windham...........	5,216	141,843	167,574	1,900	17,279	16,094	15	220	110

NOTE.—We are indebted to General F. A. Walker, Superintendent of Census, for this advanced sheet.

HARTFORD COUNTY.

BY DAVID L. WILLIAMS.

Hartford county has a population of 125,406, having made a net gain in the last ten years of 16,399. The gain appears to be in the towns in which there is more or less of manufacturing, and in those lying near the great manufacturing centers of the county. To this rule there are perhaps some exceptions.

Hartford county lies nearly in the center of the state from east to west, and extends from the border of Massachusetts, on the north, southward to near the center of the state. It lies upon both sides of the Connecticut river, so that eleven of its towns border on the river, and of the remaining towns seven lie more or less in the valley of the Farmington river, which is the largest branch of the Connecticut. The tier of towns lying on the east side of the Connecticut river are generally level and slightly hilly, and this is the general character of the towns bordering the river on the west side; but growing more hilly farther back towards the Talcott mountain range, which extends in a northerly and southerly direction nearly through the county; dividing the river lands from the comparatively level belt of land lying west of the mountains.

The general character of the soil east of the river is a sandy or gravelly loam, frequently lying on a clay subsoil, which, cropping out, occasionally furnishes material for making brick, thus adding to the sources of wealth of the community and at the same time furnishing building material close at hand for home use. The soil is generally quite easy of cultivation, and well adapted to raising grain, vegetables, tobacco, fruit, etc. Nearly or all the towns bordering the river on the west have a somewhat stiffer, more clayey and perhaps stronger soil, well adapted to grass and farm crops generally, and well adapted to raising fruit.

The making of brick is carried on to a large extent in some places; as for instance in the town of Windsor, directly north of Hartford, and also in the vicinity of New Britain.

West of the Talcott mountains the soil is again more sandy or gravelly, but in some places quite strong, and sometimes hilly, particularly in the western and northwestern parts of the county. Although the river towns have usually a supply of wood for fuel and also some timber, yet wood is generally more abundant as we go back into the more hilly towns.

The excellence of the soil in Hartford county, the ease with which it may be cultivated and the very abundant facilities for transportation to market by the river and by the several railroads crossing the county in almost every direction, and its excellent home markets for almost every thing produced upon the farm, hold out superior attractions to the cultivators of the soil.

And would not the same industry, economy, and good judgment, which are necessary to insure success in those seeking a home at the West be as likely to gain a competence here in Connecticut, where so many advantages may be enjoyed which are not to be found in the newer and more thinly settled portions of our country?

THE TOWN OF EAST HARTFORD has a population of 3,500, having made a net gain in the last ten years of 493. It is situated on the east side of the Connecticut river directly opposite Hartford, the capital of the state, with which it is connected by a bridge. The New York and New England railroad passes through the town from east to west with a station in the east part at Burnside and another on the main street nearly two miles farther west. The Conn. Central road has a station near the northern boundary of the town.

The town covers an area of about five miles in extent from north to south, and about three and a half miles from east to west. East Hartford is a remarkably level town. The meadows lying along the Connecticut river are about half a mile in width; and with the exception of a comparatively short stretch of higher ground south of the mouth of Hockanum river, they extend the whole length of the town. These meadows are annually flooded by the spring freshets, thus maintaining the natural fertility of the soil, and enabling them to yield large crops of grass well suited for mowing or pasturing. They are divided from the upland by the meadow hill, an abrupt rise of about fifteen or twenty feet.

Along the northern and eastern portion of the town the surface is in some places broken and slightly hilly, but the remaining portions of the town are unusually level. The soil is light and dry, on the upland portion, very easy of cultivation, and remarkably free from stones. A hidden ledge of rocks extends through the town in a nearly north and south direction near its eastern border, coming to the surface in a few places only ; but forming a fall or rapid in the Hockanum river at Burnside village. A small amount of quarrying has been done on this ledge.

THE HOCKANUM RIVER passes through the town from east to west, flowing for a considerable part of the distance through a valley or meadow about a quarter of a mile in width. And several smaller streams in the same general direction assist to break up the general level of the surface. There are not many springs of water in the town, but good water is generally obtained from wells at a moderate depth.

Those parts of the town not under cultivation are generally well wooded, (probably one-third of the town is covered with wood,) and the residences in all parts of the town are well adorned with shade trees. One of the most noticeable features of the town is its magnificent shade trees, particularly on Main street, and in the central parts of the town. The most common shade trees are the elm and several varieties of the maple. Bass wood is also quite common. In the forest the trees most abundant are the oaks, two varieties of the white oak, the common white oak and the swamp white oak, and many varieties of the the yellow and black oak, the chestnut, maple, white and yellow less pine, walnut, white birch, elm, poplar, and ash. There are found abundantly red cedar, hemlock, spruce, hackmatack, pepperidge, wild cherry, may-plum, beach, yellow birch, witch-hazel, buttonwood, butternut, and sassafras.

Under the head of nuts and wild fruits we find the chestnut, walnut, butternut, hazel-nut, cherry, grape, strawberry, raspberry, several varieties of the blackberry and huckleberry, cranberry, and wintergreen-berry.

There is considerable variety in the farming in this town, although tobacco is perhaps a leading crop, not only in East Hartford, but to a greater or less extent throughout the country, yet in the vicinity of the cities and larger villages market-gardening is an important branch of farming. Sometimes nearly the whole attention is given to this branch of business, but more often it is carried on in connection with the more ordinary farm crops.

The business of supplying milk to the cities and villages is attracting a good share of attention in the towns that immediately surround these busy centers, where the supply of such things must necessarily come from outside. East Hartford, with its rich meadows on the Connecticut and also on the Hockanum, is endeavoring to do its share in supplying the wants of Hartford in the last named direction. And its early and easily cultivated soil renders it particularly well adapted for supplying the city markets with vegetables and small fruits. But with very many of our farmers—doubtless far too many—tobacco is the main crop; perhaps more especially is this so where the number of acres cultivated is small.

Hartford, from its central position and the abundant and easy means of communicating with it, is the great market of the county. The first and most natural source for supply for its more than forty-two thousand inhabitants, must be from the towns lying immediately about it.

New Britain also is a city of nearly fourteen thousand inhabitants, almost exclusively engaged in manufacturing, and thus furnishing an excellent market for neighboring towns. And villages, in several instances numbering their thousand of inhabitants, are found in almost every town of the county supplying local markets of a greater or less extent.

The number of farms in East Hartford, as returned by the census, is 208.

Many of these farms, especially in the most thickly settled portions of the town, are quite small; and probably very few contain as many acres as are often found in farms in the more thinly settled portions of the state.

The average number of acres would probably not exceed fifty, perhaps fall considerably short of that number. There is comparatively very little unimproved land in the town that is not being rapidly covered with a growth of wood. As illustrating the growth of wood, I have in mind several pieces where now sticks of pine timber thirty or forty feet long, that would square six or eight inches might be cut, which were cultivated fields not more than thirty or thirty-five years ago. Oak and chestnut timber are abundant, and also pine, both in East Hartford and neighboring towns.

Formerly a good deal of wood was cut and carried to Hartford market, but the use of coal has very greatly diminished the demand for wood. Still a considerable amount is annually called for, not only in the city, but in the villages lying near.

The West is so universally acknowledged to be "the wheat field of America," that very little attention is given to raising wheat here at present. A few pieces have been raised in this town during the past year, yielding a good crop, and showing that wheat culture is not only possible, but at least fairly remunerative.

Rye is raised quite generally by the farmers about here, and is of excellent quality.

By careful estimates the amount of rye raised in town is about 300 acres, giving an average yield of about 15 bushels per acre.

Rye was worth, January 1880, about 90 cents per bushel; is worth a little more now than it was then. Straw is worth 20 dollars per ton; is worth nearly as much as hay, and has been worth more than hay within the past year. Very few of the farmers in East Hartford raise Indian corn more than they need for home use, although corn is a crop that does well upon our soil, 50 bushels per acre being a not uncommon yield.

Oats are raised to a small extent only. Beans, peas, onions are raised to some extent mainly by the market-gardeners. Almost every one raises turnips for their own use, and some for market.

Potatoes are a staple crop with us.

Some farmers this year report from 150 to 200 bushels per acre.

The number of acres of tobacco raised in the town of East Hartford this year is said to be 862. 1500 lbs. is thought to be near the average yield per acre. The price is quite variable; but the tobacco of the Connecticut valley commands a good price.

Grass, as has been already stated is an important item with our farmers. Although some of the farmers, particularly in the eastern part of the town, cut mainly upland grass, yet the main dependence for grass is upon the meadows. The Connecticut river meadows in East Hartford nearly all furnish two crops of grass annually. The yield per acre, including both crops, will probably fall little if any short of two tons.

Taking the average of the hay crop for the whole town it would perhaps fall a little short of that amount.

Probably every farm, and almost every residence in town has more or less of fruit; usually a supply of apples for home use and often a surplus for market, in years when fruit is abundant, and often pears and grapes. Plums and quinces are raised, but less abundantly. Peaches are becoming quite common, and are gaining more and more attention. We now find some peach orchards of considerable extent. Although fruit is abundant, comparatively few make fruit raising a business, or even a principal part of their business. The raising of strawberries, however, has taken the attention of our people more generally than of almost any other fruit.

East Hartford strawberries and melons—which are raised here extensively—are quite important items in the Hartford market. Just here let me mention the Hall Brothers of Glastonbury, who make the raising of strawberries and plants a specialty. Their grounds in the strawberry season are very attractive. In their line they are among the first in this section.

In describing particular farms, we will take first a large farm containing 330 acres, a part being pasture-land and a part wood, lying in adjoining towns. The farm consists partly of the river meadows and partly of the upland adjoining. About fifty acres are in mowing, estimated by the owners to yield two tons of hay per acre. Sixty acres are pasture-land, and 190 acres wood-land. The crops the past year were eight acres rye, yielding about 20 bushels per acre; one acre of Indian corn; three acres of potatoes, yielding 40 bushels per acre—a poor yield; two acres of turnips, 60 bushels; ten acres of tobacco, estimated to yield 1800 lbs. per acre; vegetables for market, or what is called market-gardening,—the sales from which amounted in round numbers to $2,800.

About 40 head of cattle are kept on the farm, and five hogs. Yearly sales of cattle amount to about $500. A supply of milk and butter for home use is produced, and also of poultry and eggs, but not as items for market to any great extent. About $350 was received for fruit sold the past season. Received for timber sold, mainly oak and chestnut, $200, wood, $250.

There was paid out on the farm for feed, $350; seed, $60; fertilizers, $450; taxes, $150; and for hired help, $1,400.

The next farm is similarly situated, with perhaps a larger proportion of upland and rather lighter soil. The farm is carried on by the owner and three or four grown up sons, who have homes of their own on the farm.

It consists of about 250 acres. In mowing, 66 acres; 62 acres of pasturing, and 50 acres of wood. The crops the past year were 9 acres of rye, estimated to yield 17 bushels per acre; 4 acres of Indian corn, 35 bushels per acre; 3½ acres of potatoes, 160 bushels per acre; and 29 acres of tobacco, 1,700 lbs. per acre. From their market-gardening the sales amounted to about $1,000.

Four horses are kept on the farm, and about 20 cows and other cattle, and 5 hogs. Yearly sales of cattle reported at about $100. Fruit raised, about 30 barrels of apples. Timber sold, mostly oak and chestnut, $150; and 50 cords of wood at 3 dollars per cord. Butter and eggs are procured from the farm for home use, and sometimes a small surplus for market. There was paid out for feed, $200, for seed, $50, for fertilizers, $1,100, and for taxes, $200. The two farms just described are among the largest farms in town.

No. 3 is also a farm lying adjoining the meadow, and containing about 70 acres, divided as follows: in mowing, 30 acres, pasturing, 9 acres, wood, 20 acres, cultivated, 11 acres. In corn, 3 acres, estimated to yield 50 bushels per acre. Potatoes ½ acre, 50 bushels. Tobacco, 7 acres, estimated to yield 1,800 lbs. per acre. Four horses are kept on the farm, and about 18 head of cattle. The yearly sales of cattle amount to about $400. Three hogs were slaughtered the past year, and about $40 was realized from what pork was sold. The number of cows kept is 5. Some milk and butter, and also some eggs are sold, but the amount could not readily be obtained. Yearly sales from poultry amount to about $35. Fruit sold, $35. There has been generally some rye raised on this farm, but they report none this year. There was paid out for feed, $50, for fertilizers, $60, for taxes, $100, for hired help, $120.

The farmer is an elderly man, and is assisted by two sons, who are married and living on the farm. I should have said the mowing on this farm is very good, and will yield 2 tons per acre.

No. 4 is a small farm of 18 acres; consisting of about 4 acres of excellent land at the homestead, which is situated on the highland a short distance back from the meadows, 6 acres of mowing in the meadow, 4 acres of outlying land of much lighter soil, and 4 acres of wood. The crops the past season were, 2 acres of rye, yielding 15 bushels per acre, 1 acre of corn, 40 bushels, ½ acre of potatoes, yielding 35 bushels, 3½ acres of tobacco, estimated at 1,800 lbs. per acre.

Nothing has been said about the garden on some of the farms described, but a good kitchen garden is almost invariably found supplying a great variety of vegetables used in the house. On this farm the garden is one of the best. About 150 bushels of apples were raised on the farm; also a few pears, and some other fruits. A horse, 2 cows, and 2 hogs, are kept on the farm. There was paid out for feed, $24, for fertilizers, $150, for taxes, $40, and for hired help, $175. The owner has a married son living with him on the farm.

No. 5 is a farm situated in the east part of the town. The house and farm buildings stand on a somewhat elevated ridge from which the land descends both east and west. To the east the farm extends across a valley and up the side of another somewhat higher ridge, some half a mile distant. The pastures lie in the valley between these two ridges. To the west the land has a gradual slope to the woods some 40 or 50 rods distant. The soil is a sandy loam, and in some places quite gravelly. The farm contains 110 acres. About 24 acres are in mowing, 13 of which is river meadow, upwards of two miles away. The average yield for the whole would be about 1½ tons per acre. About 56 acres are in pasture, and 20 in wood.

The crops were 3½ acres of rye, yielding 17 bushels per acre, 2 acres of corn, yielding 75 bushels per acre, ½ of an acre of potatoes, yielding 45 bushels, and 10 bushels of turnips. Sales of garden vegetables amount to about $25. The stock on the farm is one horse, 11 head of cattle, and 3 hogs. Sales of cattle amount to about $60 yearly; $50 is realized from pork sold, and about $175 for butter, and about $25 for pasturing. About $40 was received for eggs sold, and $20 for poultry. For fruit sold, $70. About 300 bushels of apples grew on the farm this season, and a considerable part of them were fed to the stock. There was paid out for seed, $2, for fertilizers $5, and for taxes, $50.

The owner of the farm is a man 78 years old. A son who is married lives with him on the farm, and they together do the work, except the haying. Another son who lives near, assists in getting the hay, taking a part of the hay for his work.

The principal manufacturing in East Hartford is paper-making; three paper mills being located quite near together, at the falls, on the Hockanum river, at Burnside. The amount of capital employed by the three companies is not far from $250,000. These mills furnish employment for about 90 males, and about 80 females. The average wages paid to the males is $1.75 per day, and to the females, $1.00 per day. The wages paid for laborers on the farm, would vary from 10 to 20 dollars per month, including board. The wages paid for help in the household would be from one to three dollars per week.

SCHOOLS are established and well maintained throughout the county, and in the cities and villages, and even in very many of the country districts good graded schools are found. For instance, in East Hartford, in five of the ten school districts schools of more than one grade are maintained. The State Normal School at New Britain undoubtedly has an influence in raising the standard of education in all this section. It is an influence which it is difficult to measure, or even to trace with certainty, but those who have carefully watched the progress made in educational matters will not be slow to believe that this institution has been a blessing to the State.

Hartford, besides being the seat of Trinity College, and the Theological Institute, and also one or two Female Seminaries, has probably one of the best High Schools in the State. The many railroads that center in Hartford make communication so easy that scholars come from many of the surrounding towns to avail themselves of the privileges of the Hartford High School. Scholars come daily on the cars from several towns beyond the limits of Hartford county.

EVANGELICAL CHURCHES are found in every town in the county. And the various denominations common in New England are well represented here, not a single instance being found of a town having only one denomination.

PUBLIC LIBRARIES are found in the cities and larger villages, and frequently in the country towns very useful libraries are well maintained. In some instances a library and reading-room are maintained by a manufacturing company. The Cheney Brothers of South Manchester are an example of this. A citizen of East Hartford, lately deceased, left a sum of money for the purpose of erecting a building and maintaining in it a library and reading room for the town. He gave the lot on which the building is to be erected for a public park.

Village Improvement Societies have been organized in several towns in this vicinity, to encourage public improvements.

NEW LONDON COUNTY.

BY REV. WILLIAM CLIFT.

The revelations of the census of 1880, just taken, are well calculated to awaken solicitude for the agricultural interests of Connecticut. While there is a gain of population in the whole state of 88,633, there is a loss of 12,684, divided among the 75 more exclusive agricultural towns. The statistics fairly show that there is no exception to this decrease of our population in any agricultural town in the state. The increase is confined to the cities, and the large manufacturing villages. It is by no means an unmixed evil, yet if anything can be done to arrest this depopulation of our farms, and increase the thrift and prosperity of the rural districts, every good citizen should desire its accomplishment.

New London County, though less affected by this decline than some others, yet shows a loss of population in seven towns, and a gain of twenty-five or less in three others. The gain of 8,577 is mainly in Norwich, New London, and Stonington. Groton, with four large villages upon its borders, has added only six to its population in ten years. Even Lebanon, considered the best farming town in the county, shows a loss of 366. This loss of people in the rural towns has been going on in Connecticut for the past fifty years, as the census statistics will show, but probably no decade has shown such a marked decline as the last.

New London County compares favorably with the rest of the state, for the salubrity of its climate, the fertility of its soil, market facilities, and the advantages which it offers for the profitable pursuit of agriculture. It is made up of twenty towns and occupies the southeast corner of the state, extending from Connecticut river, on the west border of Lyme, to Pawcatuck river on the east border of Stonington, and from the shores of Long Island Sound to Windham County on the north. Its facilities for marketing the products of its farms and gardens are about as good as could be desired. Besides the two cities within its borders, and its numerous villages and manufacturing towns, it has easy communication with New York, Providence, and Boston, by rail or by steamer, four or five times a day. Every town in the county except North Stonington, Salem, and Lyme is threaded by a railroad, and even these towns are within an hour or two, by horse team, of a good market. All the south tier of towns, and those upon the Thames and Connecticut rivers, have communication by sail vessels, as well as steamers, with New York and other seaports, so that the more bulky farm crops have very cheap freights to the best markets. When it is remembered that our farms, productive as they are, do not feed our own population; our cities and villages consuming immense quantities of grains and provisions from the West, because they cannot get them nearer; every one can see the advantage of this location for profitable farming. In some things we may not be able to compete with the prairies, but in the more bulky and perishable products of the farm and garden we are doing a profitable business, and with better methods of husbandry we can greatly enlarge it.

Facility of Procuring Fertilizers.

All the southern part of the county is very favorably situated. There are fish factories at Pine Island in the town of Groton, at Mason's Island, and at Mint Head in Stonington, where menhaden are taken by the million, and pressed for their oil; the flesh and bones, after the oil is extracted, are dried and sold for manure, under the names of fish scrap, and fish guano; in the raw state, as it comes from the press, it is sold for about twelve dollars a ton; without drying, as it lies in mass during the winter and spring, following the catch, it brings about fifteen dollars a ton; dried upon the platform, as it comes from the press, it brings about thirty dollars a ton. Farmers in the neighborhood buy it in considerable quantities, and cart it off in the green state, with their own teams, during the spring and in the fall. When it has to be carted a considerable distance, or goes by rail, it is more economical to buy the sun-dried article. A large portion of the water is evaporated with very little loss of ammonia. The dried scrap furnished by the fishing companies is about the cheapest form in which ammonia can be obtained for our crops. It is a powerful concentrated fertilizer, and pays for transportation to any part of the state, and beyond, wherever yard and stable manure are not made in sufficient quantities to keep up the fertility of the farm. Of course, it is a great advantage to have these factories within easy distance, so that the farm teams can cart the scrap economically during the leisure season of the year. Many other farms in this county, lying in the Connecticut and Thames river valleys near tide-water, can avail themselves of this supply of manure to great advantage, and this is fairly one of the attractions of this county as a region for profitable farming.

Although these companies take some forty millions of bony fish every year, and are constantly extending their business, and companies in other parts of the Sound, and upon the Long Island shore, are making constant drafts upon the schools of these fish, yet their number does not seem to be diminished. With all the slaughter man makes upon them with his best devices for seining them, the impression he makes upon them is hardly felt, in comparison with the wholesale slaughter of blue fish, sharks, and other sea-monsters, that pursue them like packs of hungry wolves the year round. Bony fish have been taken upon this coast for over two hundred years and used for manure, and the immense harvest of the sea is as abundant as ever. The probability is that in all coming time the supply of this fish will keep pace with the demand, and our children's children will find it profitable to use a fertilizer that the Indians resorted to before the white man came to these shores.

SEA WEED AS A SOURCE OF MANURE.

Beside fish-scrap, the farmers of all the shore and river towns, which district embraces nearly half of the county, have access to the marine plants that grow in salt water, and are thrown upon the shores by the tide and storms. They are most abundant just after the fall and winter storms, but come to land in greater or less quantity nearly through the year. These weeds are known by the common names of eel-grass, rock-weed, kelp, or Cape Ann sea moss, and sea lettuce. The least valuable of them is the eel-grass, which is gathered from the shore like the others, and pulled during the summer in the rivers and coves with long-handled rakes. A good deal of river mud is hauled up with it, and after a few days draining upon the shore or wharf where it is landed it is carted back into the country sometimes to a distance of eight or ten miles. Large quantities of this material are used by farmers living within a mile or two of tide-water, to cart into yards and pig-styes, and to mix in the compost heap with other manures. It is valued at fifty cents a load of fifteen hundred lbs. or more. A good many farmers whose lands lie upon tide-water make a business of gathering it, after haying, in large scows, and have it at cost price. Others more fortunately situated upon the islands or shores of the Sound where the eel-grass mixed with other sea-wrack is driven ashore, cart the weed directly from the shore to their yards, or to the fields where it is to be plowed in, or spread as a top dressing. Some farms have indented shores, where the mixed weeds lodge at high tide, and are retained by the loose boulders, which prevent them from floating off. After a favoring gale and high tides, a great business is made of gathering these weeds, and banking them where the tides cannot reach them. Where a farm has more length of beach than furnishes the needed supply of the farm, the beach is leased for the privilege of gathering the weed during the year. It is always a valuable part of the farm, and commands a good rent.

Besides this gathering of weed by persons who use it upon their own lands, there is a traffic in the article by persons who make a business for a part of the year of gathering the weed upon the shores, and upon the islands, and selling it upon the wharves to farmers and gardeners who have no shore privileges. Many thousand loads are thrown upon the shores of Fisher's Island, over and above what is used by the islanders. Much of this rich material is thrown back again into the sea by the tides, and is carried to other shores. A part of it is gathered in boats, scows, and small sloops, and carried to the shore and river towns, and delivered upon the wharves.

This material is mainly kelp, rock weed, and moss, and quite free from eel grass. It has been sold for two dollars a ton, but now can be had for a dollar a ton in any quantity desired. It is an excellent fertilizer for all farm crops. It is thought to be worth as much as yard manure, but is really worth much more. It is very rich in ammonia, decomposes very rapidly, and in the compost heap breeds worms, and gives forth a nauseating odor, like a putrefying carcass. For all farms lying within a mile of a wharf where this article can be procured, it is a very cheap and efficient fertilizer. In these sources of manure, fish scrap, sea-weeds, and sea mud, easily accessible at moderate cost, the farmers of the southern half of the county have a great advantage over the farmers of the inland towns. There is probably not a farm in the State that could not use profitably more than the home supply of manure, even with the best appliances of sties, sheds, barn-cellars, and sheep-barns. These extra supplies from the sea that we have mentioned are a permanent advantage to the farms of this region, and, if properly appreciated, and rightly used, cannot fail to make its agriculture attractive and profitable.

The inland towns lying north of the head of Thames river, are not without internal resources for their improvements. Nearly all these farms are well watered, many of them abounding with springs and living streams that furnish facilities for irrigation, during a large part of the year. The larger streams indeed are used to drive machinery of various kinds, but the smaller ones are rarely used, as some of them might be, to make immense crops of grass in the pastures and meadows that might be irrigated. The farm of Mr. Ayer, noticed elsewhere, is a good illustration of the great value of water as a fertilizer, and producer of wealth.

DEPOSITS OF PEAT OR MUCK

Are quite common in all parts of the county. It is rare to find a farm that has not in its own borders, or in its immediate vicinity, some muck bed, or peat bog, to furnish abundant supplies of this admirable fertilizer. Some farmers comprehend the value of these vegetable deposits, and have diligently worked these mines for many years, and have improved their farms, and made money by the operation.

CAUSES OF DEPOPULATION.

A few words as to the causes of the depopulation of our farms, may help us to right views of the remedy. It is not then, because our commonwealth is over-stocked with people, and there is no room for the expansion of our agriculture. Connecticut, two centuries and more after settlement, has only 136 inhabitants to the square mile. In Belgium, and some other parts of Europe, it is well known the soil supports nearly 400 people to the square mile, and there is no reason to suppose that this is the limit of the capacity of the soil to furnish sustenance for man; ten acres may not be enough to furnish a family with all the luxuries of life. If ten acres were worked with the best appliances of husbandry as now understood, it would furnish far more necessaries and comforts than the average farm of one hundred acres now produces. The farmer who supports his family, and educates his children, and lays up two hundred dollars a year for a rainy day, is the exception rather than the rule. The road to competence does not lie through more acres, but through a better cultivation of acres already in hand. In the market-gardens, in the neighborhood of our cities, and in the milk farms, we begin to get glimpses of what the soil is capable of producing, when skill, labor, and capital in the best proportions are applied to its cultivation. There are farms in the State that sell from the soil, principally animal products, ten thousand dollars worth, and make handsome profits. There are single acres in these gardens, yielding two or three crops in a season, and selling for five or six hundred dollars. There are quite large gardens whose average sales are two hundred dollars an acre, for years in succession. Considering our nearness to the sea, with its inexhaustible supplies of marine manure, our numerous swamps and peat bogs of unknown depth, our excellent home markets, our abundant capital, there is no reason to doubt that Connecticut can support two millions of people in more ease and comfort than it supports its present population of 626,000.

Nor is this depopulation owing to extreme poverty and discomfort among those who emigrate to the city or to the new states and territories. With few exceptions, those who leave are in comfortable circumstances, and expect to do better by the change. Many of them are enterprising young men, just starting in business, with capital enough, either owned or borrowed, to take up a homestead claim, or pre-empt a quarter section of government land, but not able to buy and stock a farm near home. They expect to better their condition by removal. Some have a decided bias to mechanical pursuits, and go where that kind of skill and labor find legitimate rewards. Some want more adventure than farm life affords, and go down to the sea in ships, or seek the marts of the city. Some are advanced in life, have acquired a competence, or think they have, and go to the neighboring city or village where their children, possibly, have gone before them. They want freedom from care, and the greater privileges which they think the cities afford. This entire freedom of choice, which comes of our free institutions, and our great prosperity, is not to be lamented. The tide that sets out of our farming districts is not a poverty-stricken crowd, starved out of home by unfriendliness of climate, or sterility of soil. The State has been a kindly mother to them, yielding a generous reward for their labors, and in most cases furnishing some capital to start new enterprises under other skies. With few exceptions, they expect to do better in other fields of labor. They leave behind them comfortable homes, good farm buildings, undeveloped resources in the water and upon the land, cultivated fields that have yielded sustenance to former owners, good schools and churches, and good society to welcome other occupants that come from the city, or from less favored agricultural regions. They do not leave the wilderness or a desert behind them. The number of cultivated acres is not likely to be diminished by the hegira, and the annual profits of the farms in the State will not decrease.

Nor is this depopulation owing to any want of capital in the state, to keep our farms in prosperous condition. Connecticut is one of the richest states in the Union, and labor is said to be better rewarded. If the real and personal estate of the commonwealth were to be divided, it would show a larger average per capita than elsewhere. However this may be, the fact is notorious that our banks and moneyed men invest a large share of their capital outside of the state. There is money enough to carry on all legitimate industries. Under the old regime farmers have been reluctant to invest their own capital in their business. Millions of money earned upon our farms have been invested in railroads, in ships, in factories, in western lands and farms because they were supposed to pay better. The risk, certainly, has been very largely increased, and immense sums have been sunk in these enterprises. The original stock of a railroad is generally sunk. It is quite common for the second and third mortgage bonds to be sunk. It is quite common for the first mortgage bonds to pay no interest for years. Manufacturing enterprises may be more successful, but almost every city and village bears witness to lamentable failures in this direction. Millions of money have been thrown away in unproductive coal mines, gold, silver, and iron mines, in petroleum wells, and in many other devices to get rich by short methods. Connecticut excels all other states in its aptitude for patents. There is no end yet visible to the devices of our people to economize labor and to get rich by inventions. One in a hundred perhaps proves a success, and a Bridgeport fattens on sewing machine factories. But men of small capital cannot afford to put their money into any of these extra hazardous enterprizes. Capital invested in a farm and managed with skill, is more generally and more surely rewarded than any other investment a man can make. Capital may be sunk in farming, from want of skill, from want of industry, or other moral causes. But it is the rarest event in the history of industrial enterprises for a skillful and industrious farmer to fail in his business. Such men, as a rule, support their families in great comfort, educate their children well, and increase their substance. They can manage their capital better than any one can manage it for them. Capital in their hands is about as safe as it is in government bonds or savings banks and pays a better interest.

To this conviction our moneyed men must come, if they have not already reached it. Even now a farmer of good business habits can hire money as cheaply upon land and mortgage as the merchant or manufacturer. He ought to get it cheaper, because there is far less risk in his business, and much less loss of time. For the farmer, there need be no idle days in the whole circle of the year. There is always a market for his products at prices that will pay something for his labor. If the capital that has been sunk in fruitless speculation had been invested in our farms it would have made the whole state available for cultivation, as a garden, and enhanced the value of our farms.

The price of farming lands in this state, as appears from statistics published by the agricultural department at Washington, is for cleared land, twenty-nine dollars per acre, and for timber land twenty-four and a half dollars per acre. The increase in value is put down at seven per cent. during the last year, owing to the revival of business. Farms can be purchased in all parts of the state at very reasonable rates, in some places for less money than the buildings originally cost. These farms, with few exceptions, are in the midst of good schools and churches, and within easy reach of good markets. Farms have passed their lowest point of depression, and we look with confidence for an increase of values and of population in the next decade.

MARKET FACILITIES OF NEW LONDON COUNTY.

The facilities for marketing the products of the farms in New London county are much above the average, even in New England. The great drawback to farming in the newer states is the lack of good home markets, and railroad facilities. Except upon the lines of the great railways, it takes the larger part of the crops, to get the rest to a good market. Here the best markets in the country are within four or five hours of the farm, and good local markets within an hour or two, by market wagon. These local markets not only consume all that the neighboring farms produce, but immense quantities of beef, pork, hams, lard, butter, mutton, lamb, corn, wheat, flour, drawn from the great cities, which get their supplies largely from the valleys of the Mississippi and its affluents. This is one great advantage of agriculture in eastern Connecticut. The producer has no doubt at all about a consumer. In a day or two he can sell every thing he has to spare, and at short notice can turn it into cash.

There are only three towns in the county, Salem, Lyme, and North Stonington, that are not touched by a railroad, and these towns are not remote from good markets. Lyme borders upon the Connecticut river, and by steamers has easy communication every day with Middletown, Hartford, New London, and Sag-Harbor, and smaller villages, during the summer season, and just across the river on the Valley railroad, there are several trains daily connecting with the larger cities. Salem is within two hours of the river, and of Norwich, and of New London, and other local markets, which are hungry for every thing that Salem can produce. They purchase immense quantities of produce that Salem farms might supply, but do not. Every farm in this town can be made to pay good dividends, if the owner, or the man who rents it, will study the wants of the local markets, and will raise what pays the most profit. North Stonington is within an hour's drive of Westerly, where there are some six thousand people, mostly engaged in manufacturing and in business connected with it. At this point there are four or five daily trains connecting with New York and the intervening cities on the Shore Line route, and still more trains connecting with Providence and Boston, and the villages along the line of the railroad. Besides this, there are small manufacturing villages in the town of Norwich within two hours on the west, and Stonington borough and Mystic Bridge, and Mystic river, within an hour and a half on the south. There is no lack of market facilities in this town. Not only is there a lively demand for all animal products, but for fruit, hay, straw, wood, timber, and charcoal. The other seventeen towns in the county are touched by railroads, and nearly all of them have manufacturing villages or cities within their borders, and their market facilities could hardly be improved, while they remain farming towns.

Stonington has four large villages within and immediately upon its borders; and more than half of its population are living in these villages, and are mainly dependent upon these farms for their supplies of food. Any surplus, above home wants, is rapidly disposed of in Providence and Boston. The turkeys sold under the name of Rhode Island turkeys in these cities, are raised to a large extent in southeastern Connecticut, and are shipped at Mystic, Stonington, and Westerly depots. Farmers, generally, that eschew rum and tobacco, and attend to their business, are thrifty in all this region. Groton lies upon the Sound between Mystic and Thames rivers, and sends a large part of its farm produce to Groton Bank and New London. The eastern part of the town has a good market at Lower Mystic and Noank.

Waterford forms the immediate back country of New London upon the west, and lies all around that city upon the Thames river. The farms here have a good market in the city, and at the places of summer resort, for almost every thing they can raise. East Lyme and Old Lyme have villages within their borders, and are threaded by the Shore Line railroad, which will convey all their surplus produce to good markets. These six shore towns are particularly desirable locations for farmers, on account of their nearness to the sea, as well as for their good markets. The ordinary farm teams and laborers can be used to gather sea-weed from the shores, or to cart it from some landing place on tide-water. In the next tier of towns on the north, we have Montville and Ledyard, lying upon opposite sides of the Thames river. This gives to each town several miles of river coast, on which sea weed from below in any quantity may be landed, with small cost for transportation. Montville has a good deal of manufacturing within its borders, and has added something to its population in the last decade from this source. Ledyard has a rather hard soil, but raises much good fruit, especially strawberries, and finds a good market for it principally in Norwich and Providence. The local markets are the Mystic villages and Poquetanuck.

Colchester, notwithstanding its manufactories of rubber, has lost over 400 of its people in the last decade. The Air Line railroad, upon its northern border, furnishes several trains daily to Middletown, New Haven, and New York, on the west, and to Willimantic, Boston, and intervening places on the east. Lebanon, one of the best farming towns in the county, has easy access to market, by the same road, on its northern border, and by the New London and Northern road on its eastern. Norwich and Willimantic are its local markets, the former two hours, and the latter less than an hour by farm wagon. Bozrah, Franklin, and Preston were formerly parts of Norwich, and readily market their produce in that city, and in the villages, within and upon their borders. These towns are all desirable for their nearness to a large market. Specialties in fruit growing, and in market-gardening might be carried on, in all these towns, to good advantage. Sprague and Lisbon were also parts of Norwich, and that city is their large market town. By the damming of the Shetucket, at Baltic, Occum, and Taftville, and of Little River at Versailles, large water power is supplied, and thriving villages have been built up, and good markets opened for the neighboring farms. Griswold is the northeast corner town of the county, and has gained in population from its thriving manufacturing villages. Jewett City, Hopeville, Glasgow, and Voluntown upon its eastern border, consume a good deal of its produce, and the surplus goes mainly to Norwich and Providence. The turkey crop, which is here a large item upon many farms, sometimes goes to Boston. There is hardly a town in this county where a thrifty farmer who understands his business may not locate to good advantage. Much depends of course in this, as in all other callings, upon the morals and habits of the man. The raw material of happy homes and competence is abundant in New London County.

As showing the extent and productiveness of farms in New London County, we give the following statistics from the census of 1870. The farms of this county embraced 227,162 acres of improved land; 86,584 acres of woodland; 19,413 of other unimproved land.

Cash value of farms, $12,878,346; value of farm tools and machinery, $352,273; value of wages paid, including board,

$598,741; value of farm products, including betterments and addition to stock, $2,895,417; orchard products, $31,027; produce of market gardens, $45,405; forest products, $168,076.

Value of home manufactures, $6,546; value of animals slaughtered $631,822; tobacco, 10,000 pounds; wool, 64,738 pounds; peas and beans, 5,766 bushels; Irish potatoes, 331,466 bushels; wine, 647 gallons; butter, 803,406 pounds; cheese, 95,613 pounds; milk sold, 389,643 gallons; hay, 66,441 tons; clover seed, 68 bushels; grass seed, 544 bushels; sorghum, 290 gallons; wax, 447 pounds; honey, 9,016 pounds.

Value of all live-stock, $2,144,279; number of horses, 3,916; mules and asses, 48; milch cows, 13,116; working oxen, 5,711; other cattle, 10,775; sheep, 20,565; swine, 7,560.

Spring wheat, 99 bushels; winter wheat, 265 bushels; rye, 16,846 bushels; Indian corn, 247,362 bushels; oats, 174,300 bushels; barley, 5,590 bushels; buckwheat, 17,546 bushels.

It will be seen by this exhibit of the productions of the farms of this county, that the largest items are forest products, which includes wood for fuel and timber, slaughtered animals, dairy products, especially butter and milk, Indian corn, oats, hay. This county takes the lead of all the counties of the state, in the production of wax and honey, a small industry indeed, but capable of almost indefinite expansion. Those who keep bees and understand the business assure us that in favorable localities the industry pays abundantly, and is capable of great expansion. This county, especially in the shore towns, has the mildest climate in the state, and this may be one reason why bees succeed so well. A few swarms might be kept upon every farm without any special provision for their support, and with the cultivation of honey-producing plants, the business might be almost indefinitely extended. Bee culture is now so far reduced to system, and is so easily learned, that it offers special inducements as a branch of farm industry. The capital is very small, the forage is free, and the labor involved is light and agreeable. The product for sale, swarms of bees and honey in the comb, has a lively demand, and there is no danger of over production. There is a ready sale for box honey in the local and the city markets at remunerative prices. The product is not very perishable, and can wait its time for sale. It is a table luxury that farmers might far more generally enjoy, with a little pains taking. The products of the apiary are almost as clear gain as the harvests of the sea.

IRRIGATION.

Among the wasted resources of our farms in New London county, are the streams that run through them. Water turned out of its natural channels on to the adjacent meadow means a large increase of grass, and more grass means more stock of all sorts, and more stock means more manure for those parts of the farm that cannot be irrigated. Increased fertility of the soil, produced by turning running water over it, means an increase of all the crops by which money can be raised. As an example of the value of irrigation we notice the farm of

ALBERT G. AYRES,

in the north part of the town of Preston. It consists of 225 acres of land of average quality with the farms in the neighborhood. It has been the homestead of the family for three generations at least. Here his father, Jonas Ayres, lived, an enterprising farmer in his time, and did a large business in raising mules, and in trading them off for the West India market. Some fifty years ago, or more, he bought the celebrated Jack Barbarossa, fourteen and a half hands high, of Frank Stanton of Stonington, and greatly increased the size of mules, for which there was then a lively demand. The beginning of the system of irrigation that prevails upon the farms, dates back to the time of his grandfather, a hundred years ago or more. Any good farmer in passing by would notice the exceptional greenness and fertility of the southern slope of this farm. This is owing entirely to the free use of water for a hundred years or more, upon about forty acres of the farm. The system of irrigation is of the simplest and most inexpensive kind, just such as any enterprising farmer could make for himself without the aid of stone mason or engineer. Near the north end of the farm a small trout brook comes in, never big enough for a mill-stream, and in summer often dwindling away to a mere rill. It is fed by springs, and in these springs the trout survive, through the heats of summer. This brook is dammed near the spot where it enters the farm, with a slight bank of earth and stone. No effort has been made to accumulate water in a reservoir against a dry time, though it could be done at small expense. Only a part of the natural flow of the water has been turned out of its channel. The irrigating ditches, of which there are several taken from the main stream, are small and narrow, and have a very slight fall.

They could be made very rapidly with a plow and ox-shovel. The forty acres put under water, slopes gently to the south and east. The water is taken out of these irrigating ditches in slight rills, and passed over the meadow. Any surplus water falls into the ditch below, or is returned to the brook. The distance for which the water is diverted from its natural channel is less than a quarter of a mile. The water is kept flowing summer and winter, and the winter flowage carries quite as much fertilizing matter as that of summer, and perhaps more. The refuse vegetable matter gathered in the swamp above, floating leaves, wash of roads and cultivated fields and brook channel, is carried down to these meadows.

The water is often discolored in heavy rains, and even that which seems to be pure, carries more or less sediment with it. The liquid manure may be very thin, but the fact is well established that wherever water runs over well drained soil, grass springs up in greatest luxuriance. The purest spring water makes grass wherever it flows. While Mr. Ayers sleeps in summer and winter, this brook is making money for him, as it did for his ancestors. The only expense to him is the slight labor of keeping the ditches clear, and of regulating the flow of the water. The soil is a gravelly loam, and slopes so much that there is no chance for stagnant water. In the opinion of Mr. Ayers the crop of hay is nearly doubled by the irrigation alone.

There are several advantages of this system of irrigation, besides the large increase of the grass crop. All these forty acres of meadow can be kept perpetually in grass, which is probably the most profitable crop upon Connecticut farms. There need be no more plowing, no more tillage-crops. The turf may thicken from generation to generation, and produce that best of all forage, a thick, fine hay made from a mixture of grasses growing upon an old sod. Then top-dressing, when it is applied to increase the year's crop, can be used to the best advantage. The manure is carried down immediately to the roots of grasses, by the large supply of water upon the surface. There is no loss from evaporation. The soil is kept to the production of nearly two tons of hay to the acre, without any top-dressing. Upon this the calculation is based of the value of irrigation upon this farm. We suppose the natural production of the land to be not over a ton to the acre. A ton to the acre then would be a fair estimate of the hay made by the irrigation. Hay sells in the neighboring city markets at from fifteen to twenty dollars a ton, according to season and quality. If we call the hay ten dollars a ton standing, it would give $400 as the annual dividend declared by the brook. The investment is about as secure as government bonds, which pay four per cent. nearly; the income is about the same as $10,000 in U. S. stocks. Not every farm has the facilities of this for irrigation, but some could irrigate on a much larger scale. Almost every farm that has a brook running through it, or upon its borders, could have some portion of its acres subject to irrigation.

TENANT FARMING.

Connecticut has the reputation of being the richest state in the Union, according to its population. However this may be, a large part of its wealth is invested outside of the State, in railroads, in mines, and in mortgages upon real estate in the cities and farming districts of the West. A capitalist, recently deceased, had nearly a half million in loans upon real estate in that region. In the past it has been thought better to make these loans, because the rate of interest has been high, running from eight to twelve per cent. Now, that government bonds pay only four per cent., and interest on good security is much lower, a new factor comes into the calculation of the capitalist, and he has to consider whether he may not find paying investments in home enterprises. There can be no doubt that Connecticut agriculture has suffered very much in the past from lack of capital. So great has been the demand for Eastern money to develop the enterprises, and especially the farms of the new states and territories, and so high have been the rates of interest, that the Connecticut farmers have not had the requisite capital to carry on their own business to advantage. While land and rents have been cheap enough, and markets reasonably good, they have lacked money to invest in labor, fertilizers, stock, tools, drainage, and other improvements. So great has been the disadvantage under which they have labored, that farms, as a rule, have diminished in value, and have been the most unsalable of property. Excepting the farms that lie in the immediate vicinity of cities and villages, and whose value is affected by this nearness to markets, it is doubted if the capital invested in farming has paid three per cent. during the last ten years. The exceptions are in cases where capital has been judiciously used and new methods have been adopted. The problem now to be solved is to bring capital and labor together, on such terms as shall give to each a better and surer reward.

There prevails to some extent, in the eastern part of New London county, a system of tenant farming, which we think helps to solve this problem. If the capitalist can get legal interest for his investment in farm lands and stock, he need not send his capital abroad. If a skillful farmer can get fair pay for his labor and skill, support his family, and save a few hundred dollars every year, he need not go out of the State to find employment.

We recently visited the farm of William B. Hull of North Stonington, and went over it with the proprietor, to study the workings of the system, where it had been in operation for a term of twenty-two years, a period long enough to fully test its value. We were favorably impressed with the system, as a fair thing both for the capitalist and for the farmer.

The farm lies in the southwest part of the town, and some of it is over the line in the town of Stonington. It is near the highest point of the Togwonk ridge, and originally belonged to that large tract of several thousand acres taken up by Thomas Wheeler, one of the first settlers in this region. If he had the choice of all the land in both towns, he could not have made a better selection. The soil, as indicated by its timber, is of excellent quality, and the decomposing granite that crops out in many places, releasing potash, is a source of fertility probably not suspected by the original proprietor. The Togwonk ridge, running through the center of the two towns, has always been noted for its rich farmers and farms, and has given rise to that saying which has come down to us from the fathers, that "Stonington was like a watermelon, the rind thin, but the core excellent." This farm passed from the ownership of the Wheelers, into the hands of the grandfather of the present proprietor. It passed to his father, Latham Hull, in 1807, and it came to him by inheritance partly, in 1858. The farm was rented by his father during the last year of his life, and has been rented for the last twenty-two years by the present owner.

THE CHARACTER OF THE SOIL.

The farm consists of 160 acres, old measure, which means 178 by actual survey. The heart of the farm is a large swale with several copious, never failing springs, which indicates grazing and dairying as the leading branches of its industry. This swale-land is wet and stony, and runs rapidly to brush and wood. It requires constant attention to keep the grass in sight. It is the head-waters of the south branch of Assekonk brook, one of the feeders of

Shunnock river. The eastern part of the farm, a hundred acres or more, slopes gently to this swale, and the western part, some forty-five acres, slopes to the east. The most of the swale is so thickly strewn with boulders that drainage would not be a paying investment at present prices of land. But a large part of the eastern slope is comparatively free from large boulders, and could be drained to good advantage. During the spring months it is so saturated with water as to make late plowing and planting a necessity. There are moist and wet patches of land on other parts of the farm, where tiles are greatly needed. The soil is a gravelly loam, with a retentive yellow loam beneath, and beneath that, in many places probably, a hard-pan that prevents good natural drainage. Some of the meadows, however, are sufficiently drained naturally, and always yield fair crops. There is an inviting field for the investment of capital in tile drainage on at least a quarter of the whole area of the farm. But no improvements of this kind have ever been attempted, and the methods of cultivation, crops, fertilizers, are mainly in the old style of husbandry. About sixty acres are kept in mowing and grain crops, seven acres in woodland, and the balance pasture.

LEASING ON SHARES.

The system adopted on this farm, and which prevails in this region, is the following: The owner of the farm furnishes the stock of manure in the yard at the beginning of the lease, which is measured by the cart-loads, as it is drawn out to the fields for use. He furnishes one-half of the stock, cattle, sheep, swine, poultry, which is undivided property, so that there may be no temptation to feed one part of the stock better than another. The tenant, on his part, binds himself to leave as much manure in the yard as he found there, to furnish one half the stock, and to keep it in as good condition as when he took it, to keep a strict account of all sales from the farm, and of all products consumed in his family, and to pay one-half of the receipts to the owner of the farm. He has the use of a garden, his fuel, and some other small perquisites, as may be agreed upon. The time of settlement is usually Christmas or New Year's. He is to keep the fences in good repair, and to conduct the business according to the rules of good husbandry. The lease runs for one year or indefinitely, as long as both parties are satisfied. It is considered best for all parties to have the lease a long one. If the tenant is expecting to leave at the close of the year, he does not look much at the future condition of the soil. He is tempted to skin the farm for his present advantage. If he expects to occupy for several years, his interest is more identified with the owner in keeping the farm in good condition.

THE STOCK.

The stock kept upon the farm the present year, which is about the average, is 25 sheep, which have produced 23 lambs, 19 cows, 5 two year olds, 4 yearlings, 1 yoke of cattle, two horses, 2 old swine, sows, which have produced two litters of pigs, and will make from 2,500 to 3,000 lbs. of pork, a dozen hen-turkeys, and about 40 hens.

CROPS AND PRODUCTS.

There are seven or eight acres of corn, an acre of potatoes, three acres of oats, and the sixty acres of meadow, producing probably seventy tons of hay, though it is never weighed. Sales of hay are rarely made, and there are this year nine stacks left over, estimated to contain twenty-five tons of hay. This large surplus of hay is kept as a safeguard against years of drought, which affects a well-cultivated farm much less than one in poor condition. When sales are deemed expedient, it is in years of scarcity, when it brings twenty dollars a ton.

THE MONEY CROPS

are almost exclusively animal products, which is a cardinal doctrine of good husbandry. These are butter, calves, beef, pork, pigs, lambs, wool, poultry, oats. The oats are sold for the purpose, mainly, of buying corn. All the corn raised upon the farm is fed out to the animals, and considerable quantities in addition. While the price of oats is about the same as corn, the feeding value to fattening animals is much less. The wood is principally white oak, hickory, white wood and chestnut, which furnishes timber and fencing, but is not sold for fuel. The vegetable crops are nearly all consumed upon the farm, which keeps up its fertility, notwithstanding the defective arrangements for making manure.

FERTILIZERS.

The main reliance for fertilizers is the manure of the stock. The principal barn is in the old style, and the common receptacle of the manure is the open yard, where the contents of the stable in the winter, and the droppings of the cattle, are mingled with dirt and refuse matter carted in. A new barn, and barn cellar with modern improvements are very much needed. They would not only save much labor in the making of the manure, but a third at least would be added to its value. Room also would be furnished for the numerous stacks of hay, which are inevitably damaged, by exposure to the weather. The wasteful process of foddering at the stack-yard would be prevented, and pine boards would be made to do the work of hay, in keeping up the animal heat of the stock during the winter. Two-thirds of the fodder fed under cover, would bring the cattle out in the spring in better condition than the whole now does. This lack of shelter for manure, crops and stock is noticed, because the success attained here is in spite of a radical deficiency in good husbandry. If anything is settled in New England farm practice in the last thirty years, it is that shelter pays abundantly. The enlargement of barn room and the very general introduction of farm cellars in our own most thrifty farming districts, attest the general belief that shelter pays. But little attention is paid to

The Orchard,

although parts of the farm are well adapted to the raising of fruit, and success with apples is attained in the neighborhood. Some four or five acres have been devoted to an orchard, which is kept in grass, and bears fair crops in alternate years, and adds something to the income. The varieties are the Rhode Island Greening, and the Prentice Russet, which is the local name for Roxbury Russett. These two winter apples have been in this region from the early settlement of the country, and notwithstanding the introduction of new sorts, they maintain their popularity, and are more generally planted than any other varieties.

Possibilities of a Togwonk Farm.

As an example of what might be done with more manure and more thorough cultivation, the owner related an incident that occurred some forty years ago. An oat crop was raised in competition with a neighbor. Beside a heavy dressing of yard manure, ashes and plaster were used, and the oats measured ninety-three bushels to the acre. The neighbor was distanced.

The Result of Twenty-two Years Tenant-farming.

As nothing but figures are satisfactory to men who have money to invest, we give the receipts of the farm which were kindly furnished us by Mr. Hall, taken from his account-book.

Receipts for one-half the products in 1872:

For calves, $93.47; pigs (18 in number) $72.62; lambs (12 in number), $51.75; apples, $20.00: oats, $37.20; potatoes, $12.00; cheese, $15.21; eggs ($70\frac{3}{12}$ dozen), $17.56; butter, (from 19 cows 845 lbs.) $308.20; turkeys, (445 lbs.) $114.20; chickens, $17.00; wool ($61\frac{1}{4}$ lbs.), $39.29; beef, $39.81; pork (1010 lbs.), $75.75. Total, $909.06.

For the twenty-two years for which the farm has been rented, he has received $15,824.20, making an average of $719.28, as the annual rent of the farm.

The farm, with the stock, came into Mr. Hull's possession at the valuation of $9,000. The annual rent is very nearly eight per cent. upon the principal. Allowing one per cent. for taxes, it would give eight per cent. interest upon the original valuation. The farm has been kept up in good heart, and will bear as good crops as when it came into his possession, and probably better. There has been some depreciation in the farm buildings, but these are still in fair condition, and will probably survive the owner.

What Show for the Tenant.

The first tenant made money steadily for thirteen years, and retired because he had money enough to buy a $6,000 farm for himself, and the larger part of it paid down. The present tenant has been on the farm nine years and seems contented, which is pretty good evidence that he is satisfied with his investment. This system of working the land upon shares offers many advantages to a young farmer, who has small capital and does not want to run in debt for a farm. It gives him at once a home with pleasant surroundings and a living business, without the burden of a heavy interest account.

FAIRFIELD COUNTY.

BY WILLIAM J. JENNINGS.

Fairfield county is of a triangular shape, and occupies the southwestern portion of the State. It embraces twenty-three towns:—Bridgeport, Bethel, Brookfield, Danbury, Darien, Easton, Fairfield, Greenwich, Huntington, Monroe, New Canaan, New Fairfield, Newtown, Norwalk, Redding, Ridgefield, Sherman, Stamford, Stratford, Trumbull, Weston, Wilton, and Westport. It is bounded on the north and east by Litchfield and New Haven counties, on the south by Long Island Sound, and west by the State of New York. It has a sound or sea coast of about thirty miles, and its extreme length from north to south is a little over forty miles. It lies mainly between forty-one and forty-two degrees north latitude. Its principal rivers are the Housatonic, Byram, Saugatuck, and Norwalk. Besides these are several others, which, emptying their waters into the Sound, afford many excellent harbors along the coast, besides making water-power for mills and factories. The Housatonic is much the largest river, and forms part of the eastern boundary of the county. It takes its rise in Massachusetts, and flows in a southeasterly and southerly direction and enters the Sound at Stratford. This river affords excellent opportunities for fishing, especially in the spring and early summer, as shad in large quantities are taken here, which are among the best caught in the United States. This river is also a resort for wild-fowl—though not so numerous as formerly—which give fine sport for the huntsman. But the more practical advantages of the river are that it affords such abundant water power which the manufacturer and artisan have not been slow to utilize. Besides, it acts as a drain to the streams and lowlands on either side.

The other rivers, though less pretentious, are important in that they afford a cheap power for mills and factories. Trout abound in many of these waters. While speaking of the water-ways of the county, it may be proper to say that springs and water-courses abound, taking their rise among the hills and shady nooks, thus giving an abundant supply of good, sweet water for both man and beast. There is hardly a farm of any considerable size to be found in the whole county but which is furnished with running water. This is of prime importance in an agricultural community.

At the west there are large districts of country where all the water used in the house and for stock purposes must be pumped from the cistern or from deep wells drilled into the solid rock.

The county having so much coast line gives it immense advantages in many ways. This coast is dotted with safe and commodious harbors—some eight or ten of them—from which vessels of different kinds sail to other ports, carrying the products of the farm and factory, and in return bringing coal, cotton, sugar, molasses, etc., etc., for the wants of the people. And, besides, the waters of the Sound always abound in fish and wild-fowl of many varieties. Hardly a fish known to these northern waters but may be taken here, from the fifty-pound striped bass to the frost-fish and smelt.

The famous Norwalk oysters, known the world over, are raised among the islands and inlets on the coast. Clams—hard and soft shell—scallops, mussels, lobsters, and a variety of other shell-fish are abundant, and can be had for the catching. Sea-weed, kelp, and rock-weed are washed ashore, which is eagerly secured for fertilizing purposes, either applied directly to the land or put into the cattle-yards and pig-pens, to be worked up into manure.

The Climate

of Fairfield county is similar to that of the other counties of the State bordering on the Sound. The influence of the water has an ameliorating effect on the weather, modifying both the heat of summer and the cold of winter. The mercury on the seaboard rarely reaches zero and seldom goes above ninety degrees. Out-door work on the land can generally be commenced by the first of April—sometimes a couple of weeks earlier—and be continued till December. Rains are more frequent and uniform, and the precipitation considerably greater than in some other portions of the country. Snow generally falls in the winter, sometimes in large quantities. This serves as a protection to the ground, and at the same time gives the farmer an opportunity to haul his fire-wood to the door on a sled, and also a season of merry sleighing to the young people.

Natural Character of the County.

Perhaps as good a description of the character of the county can be borrowed from the Bible as from any other source. What

Moses said of the land of Canaan in Deut. xi, 11—12 will not inaptly apply here: "The land whither ye go to possess it is a land of hills and valleys, and drinketh water of the rain of heaven; a land which the Lord thy God careth for; the eyes of the Lord thy God are always upon it, from the beginning of the year even unto the end of the year."

There are properly no mountains in the county, but some high ranges or elevations of land. Between these lie fertile valleys, and oftentimes some of these high elevations are capable of producing good crops. The land when first settled by the white race, two hundred and forty years ago, was heavily timbered, except, perhaps, small patches which had been cleared away for the raising, by the aborigines, of a few vegetables and some corn. It is true there is here and there a plain on a limited scale, somewhat resembling the prairies of the West, but doubtless the country with few exceptions was densely covered with timber. It is an observation founded in truth that a soil capable of bearing a heavy growth of timber is also capable, and in fact adapted, to the growing of farm crops. And this truth has had an illustration right here. The soil in this part of the State has been formed by the disintegration of the rock and of vegetable mold, the process having gone on for how many years it is impossible to say. In some sections there is a tendency to sand, or a light soil, in others to a clay, or heavy soil; but generally a medium quality prevails, which in common parlance is called a loamy soil. In several towns in the county lime-rock is found, which makes a superior article of lime. No better lime is anywhere found than comes from the kilns of Redding and Brookfield. Good building stones are also abundant, and granite of fair quality is quarried in some of the northern towns. Stones are the common fencing material, although in some sections rails or posts and boards are used.

Natural Timber—Wild Fruits.

The oaks—white, yellow, etc.,—attain here their best development. There is no timber for toughness and durability that can rival our native white oak. Walnut trees—the black, shell-bark, hog and pig, so-called,—are indigenous to the soil, and are found in all the forests. These woods are among the best for fuel, and some of them enter largely into the manufacture of implements and household furniture. Sugar, or hard maple, and soft or red maple are common. White ash, chestnut, the birches, the elms, and a variety of other trees of less note are everywhere found. The white pine and hemlock are met with, but are not plenty. The white elm is one of the most majestic of trees, and as a shade-tree it stands unrivalled. It certainly is at home here. The willow, buttonwood, butternut, wild cherry, tulip, or whitewood, bass, beech, and many others go to make up a list of our native trees. The nuts from the chestnut, walnut, and butternut bring considerable of a revenue to the boys in the fall, besides giving them seasons of recreation. Under this head the wild or native fruits may properly be noticed.

Among these are the grape, which grows in large quantities along the margins of the rivers and streams, and in most all low places. There is quite a variety of these, and before the cultivated sorts had come to be so common they were much sought after, and even now large quantities are gathered for preserving and for making into wine. The wild cherry bears profusely, but its fruit is of little account except for the birds. Wild plums are met with occasionally. The blackberry, low and high bush, strawberry, raspberry, are found growing everywhere, and the cranberry in marshes. Besides these are the huckleberry, blue and billberry.

Cultivated Fruits.

The apple, pear, peach, plum, cherry, and quince grow to perfection. Among the smaller fruits are the currant—red, white, and black—gooseberry, strawberry, blackberry, and raspberry. There is almost an endless variety of these different kinds of fruit now in cultivation, and when the grape is added, as it is grown here without difficulty and without winter protection, the list of fruits is sufficient to satisfy the most exacting. These fruits all find a ready market in the towns and cities around. The quince is having unusual attention paid to it just now. This fruit bids fair to be the most profitable of the fruits in the future. The fact that the area is quite limited where this fruit does well insures for it a quick market. It is not unusual for selected fruit to bring from $5 to $8 per barrel.

Educational and Religious Advantages.

The Common School System has been the boast of Connecticut. Besides the income of the school fund, devoted expressly to the maintenance of the schools, a tax is levied on all taxable property sufficient to defray all expenses, so that any person having children to educate, no matter how poor he may be, can avail himself of their benefits. And these schools are found in every town and neighborhood in the county and State ; so that no child need grow up in ignorance. The State undertakes to educate its children, and to this end laws have been enacted rendering it obligatory on every parent or guardian having children under their control to send them to school for at least a certain number of months each year. In the cities and large towns are graded schools where the languages and the higher mathematics are taught. The State Normal School graduates many very excellent teachers, who are employed in these schools. In addition to the public school is the academy. Very many of the towns support one or more of these. In these young men receive an education which prepares them to enter college. The parochial system prevails to some extent among certain denominations of christians. Then there are private or boarding schools, so called, where the whole expense is borne by the patrons. It is the aim of those who direct our educational affairs to make our schools second to no others in the country.

Almost all the different religious bodies have representations in this county. Among these denominations may be mentioned Baptist, Methodist, Congregational, Episcopal, Presbyterian, Roman Catholic, and several others of less note ; so that every one can have no difficulty in finding some church to his mind. And in saying that these different denominations exist expresses but a small part of the truth. Every community is supplied not only with some place set apart for religious worship, but with a well-educated and generally zealous ministry. In some of the older churches funds exist, the income of which goes towards the support of religion ; but in most cases the support of the ministry and all expenses for the maintenance of the gospel is on the voluntary principle. No man is taxed for the support of religion.

RAILROADS AND COMMON ROADS.

There are several railroads in the county, some of which are confined within county limits, like the Norwalk & Danbury, Stamford & New Canaan, while there are others which intersect and cut through the county. These are the New York & New Haven, the Housatonic, the New York & New England, the Naugatuck, and Shepaug.

The New York & New Haven road is a first-class road in every respect, having a double track, steel rail, and well ballasted. Not far from fifty regular trains pass over this road daily. The Housatonic taps the Boston & Albany at Pittsfield, Mass., and discharges its passengers and freight at Bridgeport.

The Naugatuck road has one of its terminal points, Winsted, in another county, follows down the Naugatuck valley. and enters the county at Stratford, discharging its passengers and freight also at Bridgeport. The Norwalk & Danbury railroad connects at South Norwalk with the New York & New Haven road, and the Stamford & New Canaan road connects with the same at Stamford. The New York & New England road, just being completed, connects Boston with New York, and the west, through the northern part of the county. It will thus be seen that the county is well supplied with railroad facilities.

The common roads of the county are believed to be in as good condition as any others in the State. These were laid out before railroads were dreamed of, and were intended to meet all the demands of travel and transportation. Hardly a farm can be found but is bounded in part by a public highway. In the old days of staging, when the mails were all carried by post-roads, there were several first class turnpikes, but these have generally reverted to the towns through which they passed. The roads are all free, and probably will continue to be so. These roads are under the direct supervision of the towns, and are kept in repair by tax on the property within the towns.

CITIES AND LARGE TOWNS.

The largest city in the county is Bridgeport, situated near the sound, in the town bearing the same name. It has a good harbor; and its population, including the town, is 29,148, being an increase over 1870 of 9,835. Bridgeport has a fine court house, and other public buildings. There are many heavy manufacturing concerns in the city, such as Wheeler & Wilson, and Howe Sewing Machine factories, rifle and cartridge factories, foundries—brass and iron, and many others too numerous to mention, in this connection. Two daily and several weekly papers are published. Several steamboats, besides sail vessels and barges sail from here, carrying away the vast amount of merchandise and farm products which are either manufactured or brought hither by the railroads. But Bridgeport is important to the agricultural community in that it affords an excellent market for all kinds of farm products for miles around. It being so largely a manufacturing town, there are a great many families of mechanics who depend almost entirely on the farmers for their fruit, vegetables, butter, eggs, and small truck generally. Besides hay, grain, and whatever else the farmer has to dispose of, can generally be marketed here to better advantage than by sending to New York. Bridgeport has all the elements of growth ; a liberal-minded population ; a large share of wealth; a good location; several railroads pouring a constant stream of various products into her lap; so that, provided that no unforeseen calamity befalls her, it is safe to say that twenty years hence, her population will be at least 50,000.

South Norwalk is the only other incorporated city in the county. This, including upper Norwalk and the town proper, has a population of 13,956, being an increase of 1,837 in ten years. Norwalk has a good harbor for the smaller-sized vessels, several banking institutions, a few engaged in manufactures, and withal, is a point of a good deal of importance. The New York & New Haven railroad passes through it, stopping all its trains, and the Norwalk & Danbury road has its terminus here.

Danbury and Stamford are thriving and go-ahead towns, the former having a population of 11,669, having gained during the last decade, 2,916 ; and the latter, 11,298, making a gain of 1,584, during the same time. Each of these towns is engaged to a considerable extent in manufacturing, have several banking institutions, a number of live newspapers each, churches, graded schools, and a fine agricultural country around.

Greenwich is the next largest town, population, 7,832. This is largely an agricultural town, and contains some as fine farms and as enterprising a class of farmers as can be found any where. Its proximity to New York city, being only about twenty-five miles distant, and lying along the shore, having a first class railroad passing through it, makes it very desirable as a place of residence. Many wealthy citizens from the city have their country homes in this town; and indeed all the towns along the shore are but suburbs of the great city of New York.

Bethel adjoins Danbury, and like that place, is largely engaged in the manufacture of hats. Newtown has a population of 4,013, being an increase of over 300 in ten years. This is an inland town and almost entirely an agricultural one. It contains more territory than any other town in the county. The number of acres of land returned by the assessors, exclusive of homesteads, is 29,449, and the valuation thereof $449,265, and including homesteads $737,045. The number of neat cattle in town is 2,813 valued at $63,535. Horses 599, and valued at $29,645; of sheep there are only 663, and valued at $1,661. The whole grand list is $1,844,539. It will be seen by the foregoing figures that farming lands in this town are held at low figure; that farms, including buildings and improvements, are rated less than $24.00 per acre on an average. For general farming, dairying, and sheep raising, this town is one of the best and shows the cheapness of our farm lands.

Stratford is a thriving town, having a population of 4,251; an increase of 1,219 in ten years. It is one of the oldest towns, and is in the southeastern corner of the county. The New York & New Haven railroad passes through it. Except the village of old Stratford, the town is agricultural. The Housatonic river forms its eastern boundary and separates it from New Haven county. Shad fishing is a lucrative business here in the spring and early summer; and besides, clams are caught in large quantities along its shores.

New Canaan is an inland town, and largely engaged in farming. Population 2,673, having gained 176 in ten years. It has easy access to the towns on the shore by rail or carriage road; lies on high ground commanding fine views from some of its hills, and has many intelligent and thrifty farmers. One of the largest and best nurseries in New England is located in New Canaan, and is owned by Stephen Hoyt's sons. This nursery contains over 100 acres, and all the various fruit and ornamental trees in use can be found here; as well as vines, plants, shrubbery, etc., which are contained in the catalogues of the best nurserymen. For integrity and fair dealing the Hoyts have a high reputation.

Some of the towns have gone back during the last ten years, among them are Brookfield, losing 41; Easton, 143; Monroe, 69; New Fairfield, 79; Redding, 84; and two or three others losing more or less. Weston has lost more heavily than any other town in proportion to population.

Fairfield is one of the oldest and most historic towns in the county. Formerly it was one of the shire-towns, but the smart and ambitious city of Bridgeport, lying on her eastern border, some years since coveted the prize and won it, and with it has gone also some of her best territory, thus reducing her population from

5,645 in 1870, to 3,748 in 1880. Old Fairfield stands unrivalled as a rural town. Her fine broad avenue through the principal villages, lined with fine shade trees, her court house remodeled into a town house, her spacious green, academy, public library, churches, and schools, show the intelligence and culture of her citizens. Southport, a smart little village, having a good harbor, a bank, several churches, and a good deal of wealth, belongs to the town. From this point produce in large quantities is shipped both by boat and rail to New York. Greenfield Hill, noted as having at one time President Dwight for its minister and academy preceptor, is from two to three miles from the Sound. From this hill is obtained one of the very finest views along the shore. The Sound in the distance is spread out before you, the intervening landscape is beautiful in the extreme, and the country in every direction pleasing to look upon. From this hill can be seen the spires of some eight or ten churches. The Bronson estate adds not a little to the attractions of the Hill—its mansion, conservatories, and out-buildings, together with two immense barns, thoroughbred stock and swine, tempt many to visit the place.

The town of Darien has made a fair gain, having 146 more than in 1870; the present population being 1,948. There is much good land in this town. Fruit has been cultivated somewhat, apples and pears do well. Huntington shows an increase of nearly a thousand since 1870. It lies north of Stratford, and has the Housatonic river for its eastern boundary. In area it is among the largest in the county. Many fine cattle come from this town, and although there is some manufacturing, the great mass of the people are engaged in farming. The land is generally good, and a fair proportion of it can be profitably cultivated. Trumbull is also a good agricultural town. It lies next to Bridgeport on the north, with Easton on the west, Monroe on the north, Huntington and Stratford on the east. It has hardly held its own, having gone back 12 in 10 years. This is strictly a rural town. The Housatonic railroad runs nearly through the center of it, as well as the town above, Monroe. These towns are capable of supporting a much larger population, in fact it might be trebled to the advantage of all concerned. The lands in these towns are capable of vast improvement, except the high and steep ridges; and crops of Indian corn, wheat, rye, oats, together with vegetables and fruit, could be raised at paying prices. Perhaps farming lands in many of the inland towns, with fair to good improvements in the shape of buildings and fences could be bought for $25.00 to $50.00 per acre. In the older of the western states—Wisconsin, Minnesota, and Iowa—improved farms are held at as high a figure as here.

A few of the towns have not been particularly mentioned. There is of course a variety of soil, some good as the best, some indifferent, some poor, but it is believed that none is so poor or run down but it might be brought up with a reasonable measure of good judicious work and treatment, so that what is now unproductive and little worth, could be made to yield a fair profit, and made the abode of prosperous and happy homes.

Wilton is a good town, has many well educated and wealthy men, much good farming land, but has gone back, according to the census, 116, while Westport, about the same in size, has gained 116. Their populations respectively are, 1,864 and 3,477.

Out of twenty-three towns, thirteen have increased, and ten decreased in population during the last decade. The increase has been 19,377 against 2,609 loss. The increase is found mainly in the cities and large towns. The interior towns having no business centers, but strictly rural, have diminished, and real estate has suffered accordingly. The population of the county, according to the census of 1880, is 112,044 against 95,276 in 1870. In 1850 the population was a little less than 60,000, showing an increase in thirty years of nearly 100 per cent. At that time Bridgeport contained only 7,558, while Norwalk, Danbury, and Stamford contained 4,651, 5,964, and 5,004 respectively.

DOMESTIC ANIMALS.

The number of horses in the county, by the census of 1870, is 5,652. Much of the farm work formerly done with oxen is now performed by horses. Considerable attention is being paid to the improvement of cattle and horses. Quite a number of herds of thoroughbred cattle are owned. The Jersey is coming into general favor as a butter-producing cow, and some superior animals are owned here. The short-horn is bred to a limited extent. Devons and their crosses are found everywhere, and the best working cattle in the country are from this breed. Probably no cattle for farm work can excel the Devon. Hardy, good keepers, elastic and quick in their movements, easily trained, they are the pride of many a Connecticut boy and man too. The Herefords, Dutch, Ayrshire, and some other breeds have been introduced. These all have their good points, but the great bulk of the cattle are properly native, having an admixture to a greater or less degree of choice blood, generally Devon. The whole number of cattle in the county, census 1870, is,—milch cows, 14,214, working oxen, 5,385; making a total of 19,599.

Sheep raising is a thing of the past, so far as this county is concerned, although a flock is met with occasionally. The destruction caused by dogs, together with poor fences, has discouraged most farmers from the attempt to raise them. Forty or fifty years ago almost every farm was stocked with sheep, and if the opinion may be expressed as to one cause of the diminished profits of farming, and the run-down condition of much of the farming lands in the county, we should name the loss of these flocks of sheep. Better not suffer a dog to live, or compel him to remain muzzled or chained, than forego the raising of sheep. Public opinion will demand this before long, and the sooner the better for our farming. The whole number of sheep in the county is only 6,082.

Of swine perhaps the Berkshire is the most popular. The Suffolk, Essex, Poland China, Yorkshire, Chester White and other breeds have their admirers. The whole number of swine in the county is as reported, 8,200. There are some other kinds of domestic animals not hitherto mentioned. The mule, used to some extent in hauling heavy draughts, the goat, and occasionally a jack is met with, but these two latter are more for ornament than utility.

PRINCIPAL CROPS RAISED.

Hay or grass stands first in point of value and importance, or rather forage crops—grass, hay, fodder-corn, or other soiling crops. The land, when well tilled, will bear from one to two tons per acre of good hay, and oftentimes will bear a second mowing. Good fox-tail hay brings from $12 to $30 per ton—say $18 as an average.

Indian corn, or maize, is doubtless the next crop in value for the general farmer. Forty to fifty bushels of shelled corn is a good fair crop, but on highly cultivated ground one hundred bushels of shelled corn have been grown. The climate and soil are well adapted to the growing of this crop. Of the varieties raised, mention might be made of the kind known as the eight-rowed yellow corn, a flint variety, a good yielder, and which has been in use here from time immemorial. Then there are other kinds—

Dutton, King Philip, improved, and perhaps some other of the yellow flint varieties. Yellow and white dent is raised on some of the best of our lands, and gives surprising results; although these later sorts are not considered as sure in all seasons as the flint. A good deal of the yellow dent goes by the name of Ohio corn, probably from the fact that the seed came originally from that State. Indian corn is an indispensable article of food in the family, and for domestic animals. Not half that is needed for the wants of the people is raised in the county. Lands are lying waste, and corn is brought from the prairies of the West, when it ought to be raised at home.

Wheat is grown to a considerable extent in some sections. This grain, as well as rye, does well on our soil. In favored sections and favorable seasons, the yield of wheat has been forty bushels an acre, although twenty to twenty-five is considered a good crop. Rye straw is nearly as valuable, or, in other words, brings as much in the market as timothy hay, so that with the grain a crop of rye is worth as much as wheat. Oats, barley, beans, peas, and buckwheat are raised without risk, and bring a fair remuneration for labor expended.

Among the vegetables raised are the potato—the king of vegetables—turnips, beets, carrots, onions, and cabbages. In limited sections the onion is grown in large quantities, and proves more profitable than any other farm crop. Two hundred barrels an acre is no unusual yield, and $3 to $5 per barrel is not an unusual price, although this great price cannot be depended upon. The price of this product in 1879 and '80 has been rather above than below these figures. The red globe, yellow Danvers, and white globe are the kinds mostly grown—the white globe bringing the highest price in market.

Tobacco is raised in some of the towns, also broom-corn. Sorghum, or sugar cane, is attracting a good deal of attention at present in some quarters, and some fine samples of syrup have been manufactured. The plant grows well on our best lands. In some sections in the vicinity of the large towns many devote their land to truck and fruit-raising, or, in other words, to market-gardening. Radishes, lettuce, spinach, cabbages, cauliflowers, etc., are raised and find a ready market. Strawberries, currants, grapes, and raspberries always find buyers. In short, there is nothing produced on the farm suitable for the wants of man or beast, but finds a ready market. The selling of milk is quite an industry, and is engaged in quite extensively in the interior towns. Dairy products—butter, cheese—are always in demand. Butter and cheese factories should be started in our grazing districts. There are a few factories already in existence, but their number should be greatly increased. From all that has been said, it would seem that farming ought to be a popular employment. And the question will naturally be asked, what is the matter? What are some of the obstacles in the way of success? It will be our aim in a few brief paragraphs to give some of the principal reasons for the state of things which now exists.

Doubtless the chief cause of the present low state of agriculture here, is found in the fact that the young and enterprising leave the farm for the towns and cities, or go West. If the question is asked why this is so, it will be more difficult to give a correct answer. A love of change has something to do with it, as well as a desire to acquire wealth more rapidly than can be done on the farm. A mistaken notion that farm-work is not as respectable as to be a clerk in a store, or a traveling agent, has drawn some of our best young men from the farm. Some of the details of farm work have come to be looked upon as a drudgery; and objection is sometimes made by our native young people to working along with much of the low and unskilled foreign help, which are now employed on the farm. And then, the isolation of farm-life has its unsocial aspects, so that to be a farmer means with many to be cut off from the amusements and excitements of the world. There has been a great change in farming in the last thirty or forty years, not only in the kind of help employed, but in methods and machinery; a change amounting almost to a revolution. Some have been allured by the glowing accounts which have come from the gold plains of California and elsewhere, and some are trying their fortunes at farming on a large scale at the West—the controlling purpose evidently being to make money faster and easier than on the farm where they were reared. Railroads have had much to do with the state of things now existing. The time was when large quantities of grain, cattle, horses, and other products from the farm were exported from this county. Some of this surplus found a market at the South, or in the West Indies, some went to eastern cities, but now all this is changed. The farming population have come to look upon the buying of their bread stuffs and much of their coarse grain as a necessity. This may be excused in favored localities, where vegetables and fruit have a ready sale; but in districts remote from market, general farming must always prevail; and there appears to be no reason in the nature of things why our farming lands by judicious and well-directed effort, will not pay the farmer as well as the same money and effort expended at the West or anywhere else. The soil hereabouts is capable of a severer strain than that of the West—it wears longer. There are elements of fertility here that are not found in the prairies of the West. Our rocks and stones, so much complained of as a nuisance, add much to the fertility of the soil; besides, they give warmth and protection in cold and wet seasons. It may be, too, that those who have directed our public affairs in the past have been in a measure regardless of the vital importance of our agricultural interests to the well-being of the nation, and suitable measures have not always been adopted to foster this industry. But whatever may have been the faults in the past, the general government, as well as State boards of agriculture, are now disposed to aid in any legitimate way. Agricultural societies, papers, schools, conventions, farmers' clubs, etc., are exerting a power in the land. The farmer must look out for his own interests. He must educate himself, for "knowledge is power."

WESTPORT.

Having thus imperfectly and in a very general way sketched the county, noticing some towns perhaps more fully than others, it will be our object to take up a single town and dwell on its agricultural features more in detail. This perhaps will be a better plan than to try to write up the whole; as what is true of one town is true in the main of all. There is a similarity of soil and climate all through; and although some towns may have more tillable land than others, the same principles of farming apply in all, and if farming is made to pay in one locality or town, the same principles applied to others will bring like results, other things of course being equal.

Westport is selected as the town to receive this attention, not that it has greater claims, nor because the land is better than in neighboring towns: nor because a more enterprising class of farmers are found here, but because some town must be selected, and this seems to be at least of fair average, and some things about it can be more intelligently delineated by the writer than of any of the other towns of the county.

The town of Westport fronts on Long Island Sound, having Weston on the north, Fairfield on the east, and Norwalk on the west. It has about five miles of sea-coast, and its extreme length north and south is from five to six miles, giving it an area of about twenty-five square miles. The village proper which gives name to the town, is situated about two miles from the sound, on the Saugatuck river, nearly at the head of navigation. The Saugatuck river enters the town at its northeast corner, runs southwesterly and southerly and enters the Sound near the Norwalk Islands. Vessels of considerable draught can come to the village at flood-tide, and there are several engaged in the marketing business; besides, barges and lumbermen with coal and lumber unload their cargoes here. The fact that there are three draw-bridges to pass before vessels can gain the upper docks, interferes seriously with navigation. The New York & New Haven railroad passes across the southern portion of the town, about one and a half miles from the village. The station is known as Westport, but the village which has grown up about the depot retains the name of the river, Saugatuck, which is an Indian name. A horse railroad connects the village with the railroad. The river at certain seasons abounds with fish of various kinds. Seed oysters in large quantities are taken from the river, and planted at the mouth of the harbor among the islands. These remain a year or so, and then are taken up and sold at high figures. Clams are caught along the shore, and scollops, though less abundant than formerly. The shore is much frequented in summer by parties from the towns to the north for bathing, clamming, and fishing. This is getting to be a general custom. Hardly a day passes after harvest is done but parties—men, women, and children,—come down to have a day of recreation and pleasure. The coast is irregular—indented with bays and coves,—and occasionally an outlet or creek is met with, which makes a good harbor for fishing-boats. These creeks are well stocked with eels, crabs, oysters, mussels, etc. Along the shore in several places just back from the beach, are considerable tracts of salt-marsh affording yearly good crops of salt-hay. This is much prized as material for litter for cattle-yards, and takes the place of straw or other coarse stuff. These marshes are worth from twenty-five to seventy-five dollars per acre, according to location and quality. Sea-weed and other drift stuff, and rock-weed odge on the shore and are eagerly caught up and utilized.

POPULATION

Is 3,477. The native born is estimated to be about four and one-half to one of foreign; that is about twenty-two per cent. of foreign birth. There are a few colored people, although the proportion of this class is quite small, perhaps not over one in a hundred.

TAXABLE PROPERTY.

The total grand list of the town as found by the board of assessors for 1880, is $2,092,246. This is divided as follows:

Whole number of dwelling-houses,	677,	valued at	$792.690
" " acres of land,	9,886,	" "	542,540
" " mills,	91,	" "	88,950
" " horses,	482,	" "	26,815
" " neat cattle,	1,053,	" "	31,765
" " sheep,	150,	" "	391
" " carriages, coaches, etc.,	348,	" "	21,735
" " farming utensils, above exemption,			450
" " clocks, watches, and jewelry,			5,010
" " pianos, and musical instruments,			7,850
" " household furniture and libraries,			17,350
" " quarries, fisheries, and mines,			15,800
Bank, insurance, manufacturing, and other stock,			337,340
Railroad, city, and other bonds,			29,000
Amount employed in trade,			40,400
Mechanical and manufacturing operations,			17,400
Vessels and steamboats,			3,845
Money at interest,			37,330
Money on hand,			450
All other taxable property,			61,900

The average value of dwelling-houses it will be found by this, is something over $1,100; but it must be borne in mind that two acres of land by law is allowed to go with the dwelling, as well as other buildings standing thereon. Probably the dwelling-houses and property therewith are not listed for more than half their real or actual value; and this includes many costly mansions in the village, as well as some fine country seats. Farm dwellings as a rule, the town through, are comfortable, and many of them commodious, indicating a considerable degree of wealth and refinement. Out-buildings, barns, carriage-houses, etc., are generally built for convenience and utility rather than show; although there are some elaborately constructed. Almost all farm buildings are painted, a thing almost unknown fifty years ago.

The number of acres of land as returned is 9,886. This is exclusive of what goes with the buildings and highways. Counting two acres to each dwelling-house we gain over 1,300 acres more, and if the public highways were reckoned in, as in the Western States, we would gain at least a thousand more, making in all something over 12,000 acres. This most likely is something less than the area of the town, as some land escapes the assessors, and the rivers and ponds do not count, but near enough for practical purposes. The average assessed valuation of farm lands in the town exclusive of buildings, it will be seen, is about fifty-five dollars per acre, a higher valuation, it is believed, than in some of the neighboring towns. Horses bear an average of about fifty-five dollars. Of neat cattle, animals over one year old are reckoned—oxen, bulls, cows, etc. It will be seen that while we have about 12,000 acres of land, we have only about 1,000 head of cattle, or one to twelve acres of land. Sheep make the poorest showing in town—only 150. As fifty dollars worth of farming tools are exempt from taxation, very few persons put any in the list. Bank stock stands third in the list in value, and mony on hand at the foot.

Although lying on the Sound, and having a good harbor, the amount invested in vessels is a meager sum. Much less capital is invested in this kind of property than formerly. In merchandise and manufacturing operations there is not as much activity as a few years ago. One large cotton factory was burnt a little less than two years since, but is now being rebuilt. A foundry for the manufacture of stoves is in contemplation, and it is hoped now that prosperous times have come, that business of this kind will take on new life. There are ninety-one mills set down in the list, but this does not convey the truth. They may be mills, or barns, or buildings used for storing merchandise.

GRIST-MILLS AND FACTORIES.

There are three grist-mills in town doing business. The Westport Mills, so called, about two miles from the village, on the Saugatuck; Nash's mill, one-half mile west, on Stony Brook, and Sherwood's, a tide-mill on the shore. This latter mill at present grinds only feed; but formerly it did a heavy business, principally in grinding corn for the southern market. The Westport and Nash's mills do good work, and are patronized by the farmers in this and neighboring towns. In the first is machinery for making patent flour. Mr. Edward Nash, the owner of the grist-mill which bears his name, has in connection with it a saw and planing-mill, and cider-mill. At Saugatuck, E. S. & J. E. Wheeler have a large brick factory for manufacturing cloth and metal buttons. A good many hands are kept constantly employed in this factory. There is also another large factory at Saugatuck, built for the manufacture of rubber goods, but has been used for various purposes at different times. At one time knitting-machines were made there, but latterly it has been used for making spools for cotton thread.

At Westport, or just above the village, is Lee's factory in process of rebuilding—a stone and brick structure—for the manufacture of carpet-warp, twine, wick and batting; also, a factory for making cotton, hair, and husk mattresses, and Wood's factory for wadding. C. H. Kempe owns and runs a morocco factory in the village. Besides these are two or three cider-mills, a tannery, a small woolen-factory; some five or six blacksmith shops, two carriage and wagon-shops; harness, shoe, and tailor establishments, to meet all demands; three tin and stove stores; lumber and hardware stores; also, six or more butchers' and fish markets, and stores both for dry goods and groceries, where all sorts of goods are sold, as is claimed, at the lowest figure.

CHURCHES AND SCHOOLS.

There are seven churches in the town. The oldest is the Congregational of Green's Farms. In the village are two Episcopal, one Congregational, one Methodist, and one Roman Catholic. At Saugatuck is a Methodist church. These churches are all supplied with resident pastors.

Of schools, there are ten public and two or more private. The public schools are kept open forty weeks in a year. The town is divided into ten districts, each of which has a school taught by efficient teachers. The wages paid range from thirty dollars to seventy-five dollars per month of four weeks. The Green's Farms Academy, once a flourishing institution, is for the present closed, to be opened again soon, it is hoped. This academy has done much for the intelligence of the whole community. The public schools, like all similar ones in the State, are free to all of suitable age, and are supported at public expense.

THE GREEN'S FARMS FARMERS' CLUB, as its name indicates, is an association mainly composed of farmers, and its membership is largely from the eastern part of the town. It has a membership of from forty to fifty, holds semi-monthly meetings, and has just celebrated its twentieth anniversary. This Club owns a library, and frequently invites in men from abroad to lecture to it. As a means for imparting real practical information in its own line it is invaluable.

During the winter months a young people's lyceum or debating club is usually held in the village, besides occasional lectures from distinguished persons.

RAILROADS, COMMON ROADS, AND GENERAL DIVISIONS AND CHARACTER OF THE TOWN.

The New York & New Haven railroad, as has already been said, passes through the southern part of the town on an average of about half a mile from the shore. It has two stations, Westport and Green's Farms. At each of these points is a post-office and express-office, and an additional one at the village. Some twelve or more trains stop daily at these stations. The fare on this road is about two and one-third cents per mile.

The town is divided into districts for purposes of road mending; a surveyor appointed to each whose duty it is to see that the annual appropriation of money for road purposes is judiciously expended. About two thousand dollars is annually expended in repairs, besides such sum as is needed for bridges. These roads run in almost all directions, and were laid out evidently for the convenience of the people. There must be something like one hundred miles of public roads in the town. These are generally in good condition, as the soil in most parts is of suitable quality to make hard road-beds. Green's Farms is the name of an Ecclesiastical society lying in the southeastern corner of the town, but whose boundaries are not as clearly defined as formerly. It embraces properly the school-districts of Green's Farms, Longlots, East Longlots, a part of Crosshighway, and Compo. North Crosshighway is in the extreme north part of the town. West Longlots, Poplar Plains, East Saugatuck, West Saugatuck, and South Saugatuck lie on the western side and embrace also the village. In some cases these districts have natural boundaries, such as rivers, small streams, or highways, but more generally they are arbitrary divisions made for general convenience.

The character of the soil is very much the same throughout, although there are certain districts where the soil is of a superior quality. In some places in the vicinity of springs or running water, and frequently near the sea-shore, immense beds of shells are ploughed up. In all such places unusual fertility is apparent. These deposits of shells and bones of fishes were evidently put there by the aborigines, as frequently arrow-heads and other Indian implements are found. The surface is undulating, but there are no hills so steep but that they may be cultivated. Batterson's hill is the highest land in the town, and also the poorest. From this point one can obtain an extended water view, besides a good one of the surrounding country.

Turkey hill is another high elevation about three-fourths of a mile from the Sound, and commands a charming view of both land and water. On the crest of this hill Judge Rapallo, of the Supreme Court of New York, has his country seat. A road from the Sound and railroad station leads directly over the hill. About one-fourth of a mile to the southwest is another hill nearly as high as the latter and known as Clapboard hill. The land on this hill is owned in part by Mr. F. Bedford and Judge Rapallo. Another fine view is obtained from Compo hill. This is really a promontory, jutting almost down to the water. The property on this hill is now owned in part by Messrs. McCreary, Morris, and Burnham, formerly known as the Hill property. Then there is Benjamin hill, about one mile southeast from the village, on the road to Green's Farms, and now mainly owned by the heirs of the late Charles Wakeman. From these several hills a wide and varied view is obtained, and on a clear day one can see buildings on Long Island. These several hills, except the first, contain some of the choicest land in the town, and are under a high state of cultivation. Some of these hills have a history, but it is not worth while to repeat it in this connection. There is really but little waste land in the town, although there is considerable that is neglected, and consequently growing over to brush and briars. There seems to be a natural backbone entering the town at its northeast corner and running southwesterly, in some places nearly a mile wide, which nearly disappears at the foot of Batterson's hill. Quite a considerable portion of this tract is little worth. It is ledgy, and the rock in many places comes to the surface. On a part of this tract is growing some timber. A part of it is not, and portions of it are, under cultivation. It is capable of improvement, nd much of it could be made profitable for keeping sheep were it not for the dogs.

The natural woods and fruits of the town are the same as are found in the county generally. Chestnut is esteemed for frames to buildings, for posts and rails, and is also used largely for railroad ties and telegraph poles. Cedar and locust are the most durable for posts. White oak goes into ship-building and into a variety of other things. White ash and the maples, together with the butternut, black walnut, and wild cherry are worked up into furniture, and are used largely in finishing railroad cars, public buildings, and even private dwellings. Since coal has come into such general use for fuel, the native timber seems to be on the increase. Nuts of the chestnut, hickory, butternut, and black walnut are gathered in considerable quantities in their season. The grape, fox and frost, blackberry, and strawberry are found in large quantities. In the northern part of the town are some huckleberries, and in places near the shore a wild plum is found, called beach-plum.

HAY AND FORAGE CROPS.

Foxtail, or, as it is commonly called, timothy, is the leading grass for hay. Red top, blue grass, June or lawn grass, and a variety of others, including orchard grass, are all raised for fodder. Some of these grasses have become so well established that they seem indigenous to the soil. Clover is raised most generally in seeding along with timothy. It is a plant for hay or for green fodder that ought to be more highly appreciated. It does first rate on our best soils. It is not unusual to mow three times during the season, and then get a good bite in the fall besides. Hungarian grass, millet, and varieties of corn, especially evergreen sweet, are raised either for soiling or to be cut and cured for winter use. Cattle are generally allowed to run in pasture in summer, although some are in the habit of keeping their cows up a part of the time. Horses are generally stabled the year round.

FARM IMPLEMENTS.

These are more numerous and of better quality than formerly. Among the larger implements may be named grain threshers (horse power), reapers, mowers, horse rakes, seeders of various patterns, ploughs, iron and steel, harrows of the disc and shares varieties, as well as the more common kinds, cultivators, horse and hand, many sorts, horse hay-forks, and in short about all the improved and approved kinds out.

KINDS OF GRAIN AND VEGETABLES GROWN.

Among the grains, corn, wheat, rye, oats, barley, and buckwheat are raised ; 50 bushels of corn and 25 of wheat per acre is called a good crop ; 15 of rye, and 30 to 40 of oats. Onion raising is the leading industry in a part of the town, and perhaps more money has been made from this during the last thirty years than any other one crop, or all crops together. Potatoes are grown, but not as largely as formerly. A large amount of garden truck is raised, especially along the shore, and as far as a couple of miles back. Most of this finds a ready market in Bridgeport, Norwalk, Stamford, and neighboring villages ; the surplus being sent to New York, Boston, and other eastern cities. Among the truck may be mentioned radishes, and lettuce, asparagus, spinach, cabbages, cauliflower, beets, turnips, peas, beans, early potatoes, top onions, carrots, parsnips, sweet corn, melons, etc.

FRUIT.

Much attention has been given to the cultivation of fruit during the last twenty years, comprising about all the different kinds known to succeed in this latitude. First, apples. Among the summer sorts are the early harvest, sweet bough, early strawberry, red Astrachan, and many more. The fall sorts comprise such as the fall pippin, Gravenstein, Porter, Fameuse, Jersey sweet, etc. Winter—golden russet, Roxbury russet, Baldwin, Hubbardston nonesuch, Newtown pippin, Rhode Island greening, and a long list of others. Numerous kinds of crabs are raised also, among them the Siberian, transcendent, and Hyslop.

Quite a number of extensive pear orchards are owned in town; and quite a revenue has been received from them. Some of these orchards contain several hundred trees. The leading sorts are Bartlett, Clapp's favorite, Buffum, Beurre d' Anjou, Flemish Beauty, Sheldon, Seckle. The list could be greatly extended, but *the* pear above all others for profit has been and is the *Bartlett*. This is a profuse bearer, fruit of good size, and is really the most popular pear grown hereabouts. This fruit, put up carefully in crates or barrels, has sold as high as ten to twelve dollars per barrel. The soil seems to be peculiarly adapted to this valuable fruit. Peaches are again doing well, and many are planting out large orchards. The time was when this fruit was nearly as common as apples, and as easily raised, but for many years, or until some half-dozen years ago, not much pains were taken to propagate the peach. As fine specimens of fruit have been raised within the last two or three years as is often seen. One gentleman in the place raised and sold last year (1880), several hundred bushels. (But of this more in detail hereafter.) The quince is claiming attention, and justly so. The soil in our moist land just suits them. More money has been realized from this fruit in proportion to labor and money expended than any other. It can be set out around the fences, or in the edges of marshy land, or any where, where the land is heavy and rich, with a certainty of success. And the quince is so easily propagated too. Slips set in the ground in a moist place, will root about as readily as willow. This fruit, selected and well put up, always commands a good price. The average price for the last three or four years would be not far from five dollars per barrel. Plums, cherries, and other tree fruits do well, so far as the growth of the trees is concerned. The curculio is the great enemy of the plum, and the black knot of the cherry.

Of the smaller fruits—bush and vine—the principal are the grape, strawberry, raspberry, currant, and blackberry. The cranberry is cultivated to some extent, though not enough to test its profitableness. The fruits have received much attention from many of our farmers. Two or three of our leading fruit-growers have from five to twelve acres of strawberries, several acres each of grapes and currants. A fair crop of strawberries is from 100 to 150 bushels per acre. This at eight cents a quart would net from $250 to $400. Those who have had the experience regard the currant as among the most profitable of the small fruits. The leading varieties of grapes for profit have been Hartford Prolific, Ives' Seedling, and Concord, Delaware, Catawba, several numbers of the Rogers' Hybrids, and some others are cultivated. Wilson's Albany has been the leading strawberry, and some still cling to it, but there are other sorts like the Col. Cheeney, Crescent, Great American, and Sharpless, which have given good satisfaction. The Sharpless is a comparatively new berry and promises well. Raspberries are not as much cultivated here as some of the other small fruits. Among the varieties are Brinckle's Orange, Brandywine, Antwerp, and Clarkson, Doolittle Improved, and Gregg. This fruit is in demand at good prices, but our growers do not cultivate it very largely.

The kinds of currants are the red Dutch, cherry, La Versaillaise, and white grape. This fruit is packed either in quart boxes like strawberries, or in shallow boxes containing fifteen or twenty pounds each. The average price is about ten cents per pound. The gooseberry will grow, but is not cultivated for market.

A word as to facilities for marketing fruit. The railroad company affords good facilities to our growers, stopping their trains to carry either to New York or to the eastern cities. But the bulk of our small fruit finds a ready market near home in the neighboring towns. The manner of marketing, where sent to New York, is to put it into the hands of a commission dealer who sells the fruit, charges a stipulated commission and makes returns accordingly. Fruit culture plays a very important part in the farming of this, as well as many other towns having good facilities for marketing; hence the space here devoted to it, which may seem like a repetition of what has already been said in another connection. In order to get a more clear and definite understanding of the methods and the successes of farming in the town, it may be proper to speak of individual farms and farmers, selecting such as fairly represent the best systems, and who are supposed to make the business profitable.

FARMS AND FARMERS.

The whole number of farms in the town, in round numbers, is 400, giving an average of about 25 acres to each. The largest one is that known as the Ketchum estate, owned by the heirs of the late Morris Ketchum, Esq. This is more properly an estate than a farm. It contains 510 acres. It was laid out after the English style. Park, drives, a number of conservatories, summer houses and flower beds adorn the grounds. But the outlying portions are fenced off into regular fields, and cultivated to farm crops. This tract of land lies nearly in the center of the town; much of it is level, some of it is undulating, not extra fertile naturally, but with the means at command, combined with the good taste and judgment of the late owner, it has been brought up to a high state of cultivation. The stones have been removed from the surface, firm and durable stone walls built, lowlands drained, a large outlay for fertilizers well applied, and all the other marks of an enlightened and liberal policy mark the place. Mr. K. loved rural scenes, and with his ample means gratified his tastes. At one time, and until quite recently, he was the owner, and bred some of the best strains of short-horn cattle. These formerly were *the show* cattle at our county fairs. The style of farming pursued on his farm was what would be termed general or mixed—raising those crops which were needed for home consumption. Wheat, corn, rye, oats, barley, hay, and all that was needed for man or beast. Choice fruits and flowers were cultivated, not so much for the money value as to gratify a refined taste. On this farm was a practical demonstration of what money and brains could do, and though far above what many could hope to reach, yet it is believed the example was a stimulus, and helped much to inaugurate a new era in our farming.

But few other farms contain over 100 acres. Among these are H. M. Coley, of Coleytown, who has 122 acres; Geo. Fairchild, of Green's Farms, 105 acres; A. C. Nash, of Westport, 119; H. Staples, 113; A. C. Taylor, 100; Mrs. W. Brinkerhoof, 117; Robert Martin, 100. There may be two or three more of 100 acres or more. Taking the town through, and reckoning as farms all having land over and above the homestead, the average is 25 acres. We have a few gentlemen of wealth who own fine places, but who do not depend on the income from their farms for a support. These gentlemen own from a few acres to 100, reside a part of the time in the city, and use their means freely in beautifying their places, not caring so much for profit on their outlay as to gratify their taste. They own some of the choicest Jersey stock in the State. Some of their animals have been imported direct from the Channel Islands. They are also breeders, but on a limited scale. Their herds may number from twelve to fifteen head each.

There are many practical men who make farming a business and a success, some of whom have accumulated from their legitimate calling property to the amount of $50,000 or more. It may not be improper in this connection (no invidious comparisons are intended) to go a little more into detail in respect to a few of these farms and farmers; for by so doing we will get an idea of how farming is conducted, and some of the results. And first mention will be made of T. B. Wakeman's operations. Mr. W. has a farm, or rather two farms, comprising about 70 acres, soil naturally good. His wet land, of which there was some ten acres, has been thoroughly underdrained, so that any crops are grown there, even to strawberries. Formerly Mr. W. was largely in the onion business, but some fifteen or twenty years since he went gradually out of that and took up fruit culture. Several acres were set to pears and grapes; four or five to currants, and some years as many as twelve to fifteen in strawberries. Fruit raising has been so long and successfully conducted on this farm that the owner is deemed an expert in all fruit matters. The following is a statement in detail of the products sold from this farm last year:

No. acres of onions,	8½	820 bbls.	at $3.25	$2,665.00
" " strawberries,	10	20,000 qts.	.09	1,800.00
" " currants,	5	6,400 qts.	.10	640.00
" " pears,	3	90 bus.	1.00	90.00
" " peach trees,	1½ (450)	550 bus.	1.20	660.00
" " raspberries,	½	1,200 qts.	.16	192.00
" " apple trees,	5	400 bbls.	.50	200.00
" " grapes,	5	24,000 lbs.	.03½	840.00
Garden truck, turnips, carrots, potatoes,				508.00
10 tons hay sold, $22.00 per ton,				220.00
220 bushels wheat sold, 150 bus. at $1.10,				165.00
Besides quinces, currant plants, corn not sold, and some other stuff estimated at				632.00
Being a total for one year's operations of				$8,612.00

Mr. Wakeman states that his corn crop yielded 76 bus. of shelled corn to the acre. He also says that mixed farming, combining fruit growing, is attended with more expense than common farming. Mr. Wakeman, it will be seen, is working back into onions again, the price favoring that business rather than fruit at present.

Mr. H. B. Wakeman has 54 acres in his farm, and pursues very much the same practice, with this difference, that H. B. has continued in the onion business from the first. They both went into the fruit business at the same time, and the experience and results of both, so far as fruit is concerned, are similar. Their land is very much alike, and the treatment about the same.

Here is the statement of H. B. Wakeman, for 1880:

Onions,	9 acres,	900 bbls.,	average price $3.50	$3,150.00
Strawberries,	3½ "	10,000 qts.,	.08 qt.	800.00
Currants,	6 "	8,000 lbs.,	.07 lb.,	560.00
Grapes,	2 "	6,000 lbs.,	.03 lb.,	180.00
Raspberries,		200 qts.,	.12½ qt.,	25.00
Pears,		50 bus.,	$1.00	50.00
Apples,		100 bbls.,	.75	75.00
Peaches,		50 bus.,	2.25	112.50
Garden truck,				300.00
Making a total according to this showing of				$5,252.50

It is due to state that the crop of onions on Mr. H. B. Wakeman's farm in 1880, was only about half a crop. The year preceding, his crop averaged at least two hundred barrels per acre, and the price the same, would make a difference of from $3,000 to $4,000. These farms are conducted systematically, and in the highest state of fertility and cultivation, and employ regularly during the summer from ten to sixteen men each, besides more as needed. In berry time sometimes, fifty or more boys and girls are employed. It must be remembered, and every practical man will know, that not all this income is profit. Large sums are expended for fertilizers; the wages of hired help amounts to a round sum; commissions to dealers for selling, wear and tear of tools, etc., run up a big bill, so that, if thirty-three or even twenty-five per cent. of the gross income is saved, it is not a bad showing.

A. C. Taylor owns a farm of one hundred acres. He is largely engaged in onion and fruit-raising. Onions with him are made more prominent than fruit, say ten or twelve acres of the former, and four or five of fruit,—the fruit being principally strawberries, currants, and apples. His farming is more of a mixed or general character, cultivating in addition, corn, wheat, potatoes, carrots in large quantities, and cutting more or less hay for market.

John H. Jennings, is a successful and forehanded farmer, raising a variety of farm crops, but giving marked prominence to onions. He usually raises from ten to twelve acres of onions, with a yield in favorable seasons of two hundred barrels an acre. Hay, wheat, corn, potatoes are sold from his farm. His annual average receipts must be, at present prices, from $6,000 to $8,000.

Andrew W. and Lewis B. Jennings, brothers, have been unusually successful as onion-raisers. Owning small but excellent farms, they probably have accumulated more money in proportion to capital invested than any others. Onion raising with them has been a specialty, the same ground kept to onions for a series of years, and not much else produced. Charles Meeker deserves mention as one of the most successful of our hard-working men. Starting in a small way, he has come to be among the foremost in onion raising. His last year's crop of eleven acres, he estimates at eighteen hundred barrels, which at present prices will net him $6,300. His crop of 1879 was over two hundred barrels an acre. R. G. Skiff, in addition to other crops, raised ten acres of onions estimated to be seventeen hundred barrels. Austin Jennings' crop of onions will amount to about eighteen hundred barrels from ten acres; besides, he raises hay, grain, potatoes, and some fruit to sell. And there are many others justly deserving of special mention, who are making farming in this town a very marked success; but it is not necessary to multiply examples. The one crop above all others, as a paying crop, has been the onion; and it is the steady persistent work in this direction, which has won success. Onion raising was commenced here in a very small way some sixty years ago. The business was of slow growth for many years. Until about thirty years ago it was seldom that a farmer raised more than an acre, all told, and the price averaged hardly fifty cents a bushel; but since the growth of our large cities, notably New York, an impetus has been given to the business so that now within the limits of the town, from five hundred to six hundred acres are annually grown. Some would put the average much higher. The average yield all through for a series of years, is reckoned about four hundred bushels per acre; but it is no unusual thing to produce from six hundred to eight hundred, and the best growers with favorable seasons reckon on about two hundred barrels, or six hundred bushels an acre. This would make the annual average yield about to 200 to 240,000 bushels.

Mention is made of corn, wheat, hay, and other crops. These are raised on land not adapted to onions, or where it is desirable to change off and seed down, or where a piece of sod-ground is to be reduced and got ready for onions. Wheat is a good and sure crop, and on the best land brings from twenty-five to forty bushels an acre. Corn does first-rate, and some of our farmers reported one hundred bushels of shelled-corn per acre for last year (1880). The variety which gave this enormous yield was the yellow dent.

FERTILIZERS.

One great secret, if not *the* secret, of success is a liberal application of fertilizing material, combined of course with good tillage. The material used is, first, all manure that can be made at home from the cattle-yards, pig-pens, privy, and sink-vaults; then second, such bought fertilizers as seem best adapted to the land and crops to be grown. Stable manure from the towns, and especially from New York City, leached-ashes, ground-bone, phosphates, and superphosphates, special preparations for particular crops, etc. Leached-ashes have been much used in the past, often fifty thousand bushels in a single year. The application being made broadcast on the surface at the rate of one hundred to two hundred bushels an acre.

New York stable manure is held in high estimation now. It is estimated that two thousand loads of fifty bushels each, was brought here last season. This is below, rather than above the actual quantity. It is brought in vessels and landed on the shore or at the docks in the harbors. The price varies, at present it is forty-five cents a dump of seven bushels, seven dumps making about a fifty bushel load, equal to $3.15 per load. Fifteen loads of this manure and one hundred bushels of ashes, or one-half ton of ground-bone, the whole cost being sixty to seventy-five dollars, make a good dressing for the first crop of onions. Afterwards, if the land is naturally good a less amount will do. Leached-ashes are delivered for fifteen cents per bushel. Ground-bone thirty to thirty-two dollars per ton, the phosphates a little more, and special patent fertilizers all the way from the latter figures, to fifty dollars or more a ton. Guano is little used for general farm purposes. Gypsum, or plaster of Paris, is used to some extent; its good effects are more visible some miles back from the shore.

FUEL.

Coal is the chief article of fuel, costing from $3.50 to $5.00 per ton. Wood by the cord sells for $5.00 to $6.00. A good assortment of hard and soft-wood can be had, also charcoal, this latter costing generally about twelve cents per bushel. There are some peat-beds, but not worked much at present.

FARMS, PRICES, ETC.

Farms range all the way—in this town,—from $25.00 to $200.00 per acre. The best onion lands readily bring the latter price, and more if conveniently located. In the interior and north part good tracts of land can be bought for $50.00. Not many farms are for sale in the town, although some are changing hands. There is quite a proportion of unimproved land, formerly cultivated, but now in pasture, growing over to brush and briers, although this class of land is not met with as frequently, as in some of the adjoining towns.

A good sound horse, young and well broke for farm work, is worth from $150.00 to $200.00. A good team of working-oxen about the same. Cows, common, $30.00 to $50.00.

The price, or wages paid for good experienced farm hands is from $15.00 to $20.00 per month and board; green hands $8.00

to $12.00. Good servant-girls get $10.00 to $14.00 per month. Day wages for men without board, from $1.25 to $1.75 per day in the summer season.

It is proper to state that while the price of some farm products at this time are above the average, others are below. Onions, hay, and straw are above, but grain and fruit are below; so that taking it all in all, the farmer receives a fair average price for his products. Wheat is bringing $1.10 to $1.15 per bushel; corn, 65 to 70 cents; oats, 40 cents; hay, $25.00; good straight rye straw, $20.00 to $25.00 per ton; potatoes, 60 cents per bushel; butter, 25 to 30 cents; and cheese 14 cents per pound; eggs, all the way from 12 to 35 cents per dozen, according to the season.

A word in closing this sketch. It is not claimed that absolute accuracy has been attained in the statements and statistics of the foregoing sketch, but it is believed that they are approximately correct,—as correct as is possible with defective material to work with. Enough is shown to demonstrate, that farming will and does pay when intelligently and persistently engaged in, even here in this part of Connecticut. Some may say that Westport is an exceptional town. This is not so. There are many towns in the county able to make as good a showing as this, and if they do not the fault is not in the land.

Perhaps $25.00 an acre is a fair average of farming lands in the county, including improvements. Of course this includes good, bad, and indifferent. There are many farms held for sale, besides tracts or parts of farms.

When the many advantages are considered—good and well organized society, churches, schools, a ready and quick market for all that the farm produces,—it seems strange that this state of things should exist; it ought not to exist, and a reaction will most certainly come, if indeed it has not already begun.

It may be a little out of place, but this fact should be noted; to wit: that very many of foreign birth, who first came among us as common laborers, have by their industry and economy provided themselves with comfortable homes, and are among our thrifty and well-to-do citizens. And there is nothing to hinder any man of industrious and steady habits, from gaining competence, as well as position in society.

WINDHAM COUNTY.

BY REV. WILLIAM CLIFT.

MARKET FACILITIES.—Four out of the fifteen towns of Windham county are touched by no railroad, viz: Voluntown, Ashford, Eastford, and Woodstock. Voluntown is among the poorest towns in the state as to its soil, and was among the last to be taken up. It was parcelled out to volunteers in the early days and takes its name from that fact. It is the home of granite ledges, shrub oaks, white birches, and pitch pine, which are not indications of a fertile soil. But the Pachaug has its rise in this town, which furnishes water-power, and thriving villages have sprung up along its banks. There has been an increase in population here in the last decade. There is much land still in forest, and charcoal burning is an important item in the products of the farm. Voluntown borders upon Rhode Island and there are several factory villages that afford good markets for the farmers. A good deal of the charcoal, as well as other produce, is marketed in Norwich. The people formerly had rather a hard name, as well as a hard soil to contend with, but during the present generation there has been steady improvement in morals and temporal thrift, and the town is not much behind its neighbors in all acquired advantages. The granite soil has not so many attractions as many other parts of Connecticut. Ashford and Eastford have both lost population since the census of 1870. They have not much manufacturing industry in their borders, and no large markets. Their surplus products however, are brought to the New London Northern, and to the New England railroads in adjacent towns, not more than two or three miles distant. These are good grazing towns, and in the value of farms, live stock, and hay, they compare favorably with other parts of the county. Woodstock has the largest area of improved land, the highest valuation of farms and farming tools, of live stock, and of farm products, of any town in the county. It has a flourishing Town Agricultural Society, with ample grounds and buildings, and its annual exhibition, and this may be a cause as well as a result, of its large prosperity. It has a well sustained Farmer's Club, with frequent winter meetings under the lead of Dr. Bowen, which has done much to stimulate the improvement of the town in horticulture, agriculture, and rural adornment. The natural scenery of the town is unsurpassed even in Connecticut, and this, with the general intelligence and social culture of the people, has made the region attractive in summer to city people, who prefer the quiet rural life of their younger days to the pomp and show of the larger summer resorts. Not a few of these people are stowed away in the thrifty, comfortable homes of Woodstock during July and August, and dispose of a reasonable amount of farm produce, while they add something handsome to the farmer's income. The manufacturing villages of Thompson and Putnam absorb a good deal of the fatness of these farms, and the balance finds outlet at Putnam to more distant markets. All the other towns of the county are penetrated by railroads, and have good local markets, or ready access to large cities.

For the last fifty years the farmers of this county have been much benefited by their nearness to Providence, even before the advent of railroads. These new facilities have added much to their profits. Formerly a large business was done in raising pork and cheese for this market. Western competition has dwarfed the pork and cheese product, and turned the attention of the farmers to other crops. The making of butter for the winter, as well as the summer trade, and the supplying of milk to village and city customers, are growing industries. Fruit culture is receiving a good deal of attention and the apples of the county are not surpassed in any part of the state.

Of all the towns, Windham reports the largest increase, 2,853 since 1870. The most of this increase is in Willimantic, which has become one of the most important railroad centers in the state. The rapid descent of the Willimantic river furnishes great water power at this point, and can hardly fail to make it the center of great manufacturing industries. Willimantic is a good market not only for Windham, and Scotland, but for Chaplin, and Hampton, adjacent towns on the New England railroad. Scotland also finds an outlet for its produce in Baltic, and other factory villages. South Canterbury has some manufacturing in its own borders, and has frequent access to Norwich and Providence by the Fishkill and Providence railroad, that passes through its borders. Plainfield is a better town for farming than Canterbury, has a much larger village population, and as two railroads cross at the junction, has better facilities for market. Produce can be sent direct to Norwich, Willimantic, Hartford, Providence, Worcester, and Boston without any change of cars, or breaking bulk, and without delay. And this junction of railroads makes Plainfield, Willimantic, and Putnam, and their immediate neighborhoods, particularly desirable locations for nurserymen, market gardeners, fruit growers, and milk producers. Any one living within an hour of these depots, would have their choice of six good markets, and could expose his products for sale in the freshest condition, and sell on the top of the market. This might not be of much advantage to the small cultivator, whose whole production would be readily taken in a small village, but to the larger producer, with ample capital, it would be a great attraction. Killingly, Putnam, and Thompson have thriving manufacturing establishments in their borders, which consume all that the neighboring farms can raise, and import largely from the prairies besides. Sterling is rather hilly, and among the less productive towns of the county. But the Providence and Fishkill railroad passes through it and this is a compensation for some of its drawbacks. It can sell everything it can raise the same day it is ready for market. Woodstock, Pomfret, and Brooklyn lie mostly upon elevated land, and are reputed to be the best farming towns of the county. The high ridge running through these towns has a fertile soil, easily cultivated, and boasts of many elegant homes, with people of refinement and culture.

As showing the value of the principal products of the farms of Windham County, we give the following statistics from the census of 1870:

Acres of improved land in the county, - -	190,649
Acres of wood land, - - - - -	74,094
Acres of other unimproved land, - - -	10,399
Cash value of farms, - - - -	$8,193,266
Cash value of farm implements and machines, -	293,340
Total amount of wages paid, including board during the year, - - - - -	314,906
Value of productions, including betterments and additions to stock, - - - -	2,245,202
Orchard products, - - - - - -	33,250
Market garden products, - - - -	17,600
Forest products, - - - - - -	154,058
Home manufactures, - - - -	15,212
Animals slaughtered and sold for slaughter, -	505,166
Value of all live stock, - - - -	1,548,925
Horses, (number,) - - - - - -	3,238

Mules and asses,		18
Milch cows,		10,064
Working oxen,		3,995
Other cattle,		7,023
Sheep,		10,176
Swine,		5,978
Spring wheat,	bushels,	89
Winter wheat,	"	21
Rye,	"	16,094
Indian corn,	"	161,414
Oats,	"	167,574
Barley,	"	7,752
Buckwheat,	"	22,109
Clover seed,	"	1,598
Grass seed,	"	3,526
Wax,	lbs.	108
Honey,	"	3,247
Tobacco,	"	5,685
Wool,	"	36,526
Peas and beans,	bushels,	1,736
Irish potatoes,	"	297,431
Wine,	gallons,	561
Butter,	lbs.	517,509
Cheese,	"	375,696
Milk sold,	gallons,	260,778
Hay,	tons,	58,734

THE APPLE ORCHARD.

To one visiting Windham County in the even years, nothing is more noticeable or more attractive than its orchards, burdened with the best varieties of winter fruit. In some of the towns, notably Brooklyn, Killingly, Pomfret, and Putnam, fine orchards are the rule on every farm. The soil and climate are well adapted to the apple, and as perfect fruit can be raised here as in any part of the world. The abundance of this fruit in all this region is no doubt owing to the nursery of Paris Dyer & Son, located in Brooklyn, who for many years devoted themselves to the production of fruit and ornamental trees. They were intelligent and conscientious cultivators, and sent out only thrifty and well-rooted trees of the best varieties then known. In the bearing years apples are so plenty that hand-picked fruit of the best varieties is delivered at the depots for one dollar a barrel. Even at this price the orchard pays fairly, if its abundance is properly husbanded. Farmers are beginning to learn the value of apples as a feed for stock, as well as for human food. They are not only wholesome aliment for man, and should be upon the table in some form every day in the year, but are highly relished by domestic animals, and if judiciously fed with other varieties of fodder, make eggs, poultry, beef, pork, mutton, and other animal products. In the odd years, when the apple crop is less bountiful, prices are better, and two and three dollars are frequently realized. There is really no danger of an over-production of this crop, if the farmer plans to utilize it. In recent years the exportation of apples to Europe, especially to England, has become an important item in our commerce. The business has been larger than ever this season, and from the port of New York alone, an average of 16,000 bushels a day, during the height of the season, have been shipped to foreign countries. The British Isles, as is well known, are not so favorable to the cultivation of the apple as our own northern states. And there are other influences at work beside the climate to discourage the cultivation of this fruit. One of the editors of the *American Agriculturist* traveling in Europe this summer notices particularly the

ABSENCE OF ORCHARDS.

"In the long journey from Cork to Dublin and Liverpool, and thence to this place, within about 50 miles of London, I do not think more than a hundred or two apple trees were seen, and these in such small clumps that they could hardly be called orchards. Upon inquiry as to this absence of orchards, the reason assigned was, that the land was rented, and the tenants did not care to plant trees upon land which they might be obliged to give up at any time. This must be a very poor apple year, as in the above-named cities I saw in the fruit stores, and on the street, the most wretched fruit, gnarled, specked, and so poor that our farmers would reject them even for cider-making. In the abundance of our own crop it is probable that a much larger amount will be shipped than ever before. Plums seem to be the most abundant fruit, and often very good; have seen no very fine pears, but it is probably early as yet."

We have no doubt that the growing of apples, as a specialty in farming, can be made profitable in Windham County, and this probably is among the industries that will be expanded in the not distant future. The railroad facilities are abundant and car-loads of apples can be put on to the wharf in Boston in two or three hours, from any depot in the county. As an example of what can be done in growing apples on a large scale, for the European market, we give the following description from the *Country Gentleman*, of

A Great Orchard.

"The fruit farm of Robert McKinstry, near Hudson, N. Y., contains 33,000 trees—the largest number of apple, pear, and cherry trees, taken as a whole, in this country, and probably in the world. His farm of about 300 acres is wholly planted with fruit trees. The soil is light, gravelly loam, with a natural drainage, and is well adapted to the growth of fruit. Six miles of orchard roads extend through the grounds, for access and conveying away the gathered fruit. From forty to seventy men are employed in gathering, assorting, packing, and drawing to the railway during the busy season, which extends from early June to approaching Winter.

"The apple trees, which are 26,000 in number, are planted twenty feet apart, with the intention of removing alternate and diagonal ones when they interfere in growth. The first were planted twenty-five years ago, and the average are about fourteen years old. At present they have full space. For a few years they have borne good crops—two years ago over 20,000 barrels. These are all, or nearly all, sent to Europe, the shipping being commenced in August. Complete arrangements are previously made for this purpose, and in one case Mr. McKinstry received a cable dispatch of the arrival and sale of a consignment ten days after it was sent to Catskill station. Two or three cars are frequently loaded in a day. They succeed best by being gathered rather early.

"The following is a list, with numbers of trees, of most of the apples planted in this orchard: 7,000 R. I. Greenings; 7,000 Baldwin, Es. Spitzenburgh; 4,000 Tompkins King, Ben Davis; 1,000 Red Astrachan, Oldenburgh; 1,000 Northern Spy, W. Seeknofurther; 200 each Hubbardston Nonesuch, Wagener, Roxbury, and Golden Russet. The orchard is kept well cultivated, horses ploughing the spaces between the rows, and oxen the ground nearest the trees, to avoid injury with whiffletrees. Two yoke of oxen are constantly employed for this purpose, and sometimes four, and four or five teams of horses. Care is specially taken to drive the oxen gently, that they move quietly, and they soon learn to make voluntarily the required deviations to plough near or between the trees. On the approach of Winter a bank of mellow earth is thrown up with a plough against the trunks to exclude the mice. This constant cultivation has given fine fruit, specimens of the Baldwin having been obtained which weighed a pound, and of the Tompkins King weighing twenty-one ounces.

"The cherry has been found quite profitable for market. The orchards contain 4,500 trees, largely of the following sorts: 500 Governor Wood, 500 Napoleon Bigarreau, 800 Black Tartarian, 200 Rockport Bigarreau, 200 or 300 Morello, 200 or 300 Early Richmond, and other varieties, extending to over twenty sorts. The trees are about eleven years old. The past season, which was so dry as to be injurious to the apple trees, favored the securing of the cherry crop, over twenty-five tons having been sold, with scarcely the loss of a bushel by rotting. The different sorts ripening at different periods, prevented the pickers from being overcrowded with work at any time, and not more than thirty-five were required at once, who would gather about two tons in a day. The fruit was sold chiefly in the New York market, at from seven to eighteen cents per pound. At twelve cents, the twenty-five tons would bring $6,000—a good return for forty acres. The soil appears to be peculiarly adapted to the growth of this tree, and it is occasionally necessary to sow oats in the orchard to reduce the vigor of the trees and prevent bursting of the bark. Mr. McKinstry has had in one instance nine bushels of cherries from a tree of the Napoleon Bigarreau.

"Among the 2,000 standard pear trees are 700 Bartletts of handsome growth, besides which there are 200 each of Seckel, Sheldon, and Anjou. Buerre Bosc proves one of the best market sorts. We have seen very little indication of blight among the pear trees.

"The borer proves to be the worst enemy of the apple tree, and the many trees which have been destroyed have been promptly replaced by replanting. The only remedy is opening the holes of this insect with a knife, and destroying with a flexible wire. Sometimes a dozen have been found in a single tree. The codling moth has given little trouble. Mice were formerly quite destructive, but they are excluded now by the remedy already mentioned—namely, by ploughing up mellow earth against the trees.

"Besides the preceding named kinds of fruit, Mr. McKinstry has a vineyard of 1,700 Concord grapes, an orchard of 1,000 peach trees, another of 200 crabs of different varieties, and the highway is lined with 450 maples. He gives constant personal attention to the management of his orchards, which show the superintendence of a skilful hand, although the trees had suffered this year by a long-continued and extraordinary drouth."

This shows what may be done with apples and other fruit when cultivated as a specialty. But if there were no market for apples at home or abroad it would be a paying crop as

FOOD FOR STOCK.

The crop is not much used in this way, because as a rule it pays better to send apples to market, either as fruit or as cider and vinegar. Then from the injurious effects of overfeeding, when cattle are turned into an orchard from a lean pasture, there is a prejudice against the article. Nothing can be more unreasonable than this prejudice. An animal may be injured by gorging with almost any kind of food. The use of apples, both in the raw and cooked state, is steadily gaining, and some of our most intelligent cultivators have experimented so far with their use, that they prefer to feed out their refuse apples rather than to make them into cider or vinegar. Stock need, especially in winter, some kind of succulent food as an additional ration to hay and grain, and are probably benefited by it more than chemical analysis of fruits or roots would lead us to expect. Apples are a good substitute for squashes, and pumpkins, or for the various kinds of roots cultivated for cattle feed. In a visitation made to some of the best farms in Windham county, in the fall of 1878, the committee of the board of agriculture found the practice of cooking apples for swine very common. Cooked with potatoes and meal they are highly relished and add to the thrift of the animals. Alexander Hyde of Lee, Mass., gives his large experience in the use of apples upon his farm in a recent article in the *Country Gentleman* :

"Horses, cattle, sheep, and swine are exceedingly fond of apples, and if fed judiciously they thrive upon them. The old notion that this fruit relaxes horses, dries up cows, and is worthless for the production of beef, pork, and mutton has been discarded by observing men who have experimented with it. True, apples, especially unripe fruit, may be fed in such quantity at first as to do damage, causing derangement of the bowels, and such a general inflammatory condition of the system as to diminish the flow of milk. Green apples are unfit for man or beast, though a hog will eat them with impunity ; but ripe fruit is always healthy if the rations are not too large. Even corn meal does damage when fed in excess. All domestic animals are so fond of apples that they will gorge themselves when first allowed the free range of an orchard. The true way, therefore, is to feed apples in small rations at first, say half a peck, twice a day to a cow, and when she has become accustomed to them to increase the allowance to half a bushel a day. I have known a bushel to be fed each day, with manifest advantage. For three months past, I have fed a cow with three pecks of apples at three feedings each day, with the result of a large increase in the flow of milk, and a marked improvement in its quality. Moreover, she has steadily gained in flesh, and is now good beef. For the same length of time I have fed my horses a peck of apples each, twice a day, after a short trial of half a peck at a feeding, and never knew horses do better, although they have been worked constantly. Their hair is smooth and glossy, their flesh solid, and their excrement moist, but not excessively so. The store pigs have had hardly anything else but grass and apples and are in good growing order. As I keep no sheep, I could not try the experiment of apple food upon them; but a neighbor who picked apples until he was tired of the job turned his flock of sheep into his orchard, to do the remainder of the harvesting, evidently to their great advantage. I have great confidence in feeding apples, as my experience is not limited to this year. Having a large orchard and raising apples by the thousand bushels, I have fed them to stock for a series of years, and uniformly with paying results. Exactly what apples are worth for feeding my experiments have not been definite enough to enable me to determine. So far as horses are concerned, I am satisfied that two bushels of apples and one of oats are as efficient in promoting their health and strength as two bushels of oats. The fruit seems specially well adapted to horses. In the epizootic of 1872, and in that of this year, horses would eat apples, when they would not eat oats. In both the epizootics my horses were allowed daily rations of this fruit, and had the disease very lightly. For cows and swine I think apples are worth as much as English turnips, say from ten to fifteen cents a bushel. Prof. L. B. Arnold puts their value at twelve and a half cents a bushel. The value of apples as food for stock was discussed at the meeting of the Massachusetts board of agriculture, in 1875, and Mr. T. S. Gold, secretary of the Connecticut board, said, 'From my own experience in feeding thousands of bushels, not only as falling from the trees, but gathered in the barn cellar as winter stores, for neat stock, horses, sheep, and swine, I would place their value nearly as high as Prof. Arnold. The sweet and firm-fleshed varieties would of course be preferred, but a mixture of sour ones need not be feared. The possibilities of yield of an orchard are such as to make its value for stock-feeding alone, take the very front rank among cattle foods.' This opinion of Mr. Gold was confirmed by several others, and disputed by none. One spoke of feeding from twenty-five to fifty bushels per day to milch cows, and considered them worth more to make milk than potatoes or pumpkins. Another said he had fed a bushel of apples a day to each of his cows for six weeks and was satisfied that they increased the quantity of milk, and improved its quality. The flavor of the butter was better. If such is the value of apples for stock-feeding, I hope no farmer will allow them to rot on the ground. If he has no storage room in his house or barn cellar, they can be stored in the ground. Dig a hole or trench, the same as for turnips, in some sandy or gravelly spot that will not retain water, and cover them with eighteen inches of earth, and they will keep better than in a cellar. Two years ago I buried a lot in this way, and they came out in the spring as fresh and crisp as though just picked from the trees. This year I have buried hundreds of bushels, and have no fears that they will not keep well. In no place can fruits and roots be kept so well as in dry earth."

The fine orchards of Windham county, most of them in good bearing condition, we consider one of the strong inducements to retain the present population upon their farms, and to attract others to their neighborhood. If we accept these testimonies of practical men who have experimented with feeding apples for many years, their value as food for stock is higher than chemical analysis would show. It helps the digestion, doubtless, of other varieties of food, so that hay and grain have a higher nutritive value for being used in connection with fruit. If they are worth half as much as oats when fed in connection with that grain, as Mr. Hyde testifies, then livery stable men and villagers can afford to pay twenty to twenty-five cents a bushel for them for horse feed. Where milk is marketed in the village, or at the depot for the city market, they must be quite as valuable as a daily ration to milch cows. The milk trade in this county is already large, and from the large village population engaged in profitable manufactures the trade must have a steady increase in the future. The apple orchards then, even if there were only the farm market, could not fail to be a profitable branch of farming. They can be turned into beef, pork, milk, butter, veal, lamb and mutton, pigs, poultry, and eggs, and sold to advantage. In most years the assorted winter fruit brings a remunerative price and in the odd years it pays largely.

In connection with the apple orchard, which is the only fruit among us fairly popularized, the cultivation of small fruits is made a paying industry upon not a few of these farms, and there is plenty of room for the enlargement of this industry.

STRAWBERRY CULTURE, AND OTHER FRUITS.

The soil is well adapted to this fruit, and the cultivation is so well understood, that the strawberries sent to the city and village markets in our State are much superior to those which come earlier in the season, from New Jersey and States further South—and they realize better prices. This superiority is so decided that there is little difficulty in disposing of strawberries in any quantity in which they have been grown, in the near villages, within an hour or two of the farm. The cultivation of this fruit has not received so much attention in this, as in New London County; but enough has been done to demonstrate its profitableness, and to encourage investments in the business. In my visit to Windham County in the fall of 1878, I found several farmers quite largely engaged in this, and other kinds of fruit culture, which has grown, doubtless, out of the profitable experience in apple orchards.

Charles H. May of Woodstock, in addition to his fine orchard, keeps a strawberry patch to supply the local markets. His varieties are the Monarch of the West, Crescent Seedling, Ida, Green Prolific, and Charles Downing. Of these the Green Prolific is the most abundant bearer, and the Charles Downing is of the best quality. The Crescent is a new variety, remarkably vigorous, and productive. The foliage remains green and thrifty into late Autumn. Mr. May finds it much more profitable to supply the home markets with strawberries than to send to the large cities where the express charges, and the commissions consume a large part of the profits. In selling fruit in any place within three or four hours of the farm, the most of it can be sold by the season, directly to families, to hotels, boarding-houses, and restaurants for daily delivery. No time is lost in looking up customers, and no commissions are paid out for handling. The fruit comes from the producer to the customer, generally on the day of picking, or the morning following, and is in the best possible condition. Such fruit is preferred to that grown in New Jersey, and sells for better prices. Fruits are generally much cheaper through the Summer months in New York, than in the large towns and villages of Connecticut. The strawberry is just becoming popularized, and has almost ceased to be a luxury in the month of June. They are so cheap, that they are within reach of the great majority of our village and city population, and it is this general use of this delicious fruit that encourages production, and promises to make strawberry culture among the surest and best investments upon the farm for the future.

Not much attention is paid by Mr. May to pear culture, beyond the supply of the family; and the season is rather short for the better varieties of the grape. Peach culture receives attention, and in some years is remunerative. The yellows is the great enemy, and until we have learned how to control this disease, not much success can be anticipated. A few "Stump the World" peaches were left upon the trees, which gave us a good idea of the capacity of the soil for peach growing. Mr. May is experimenting with a preparation of salt and ashes, as a cure for the yellows, and thinks he has found a specific. If so, it will be a matter of great importance to the peach-growers of the country.

Paris M. Law is much more extensively engaged in peach culture than Mr. May. His orchard lies upon the eastern slope of the sharpest hills in town. The land is rather poor for Woodstock, being what is called "fifteen dollar land." It is a gravelly loam with many small stones in it, and seems well adapted to peach growing. He has put out 2,400 peach trees on seven acres of land.

They are planted in rows one rod apart, by eight feet three inches in the row, with apple trees two rods apart, to take the place of the peach trees when they have failed. The spaces between the rows are planted with corn. The design of this corn planting is to check the growth of the peach trees, and prevent them from bearing too early. This idea is borrowed from the practice of Maryland peach-growers. He has planted 600 trees of the Early Crawford, 400 Beatrice; 400 Early Louise, 100 Late Crawford, 100 Honest John; Richmonds and Red Rare-ripes are among the other varieties. The plantation was made in 1875, and the trees were from the nurseries of Leavitt of Newburyport, Mass., and from T. C. Thurlow. Some of the trees were too light colored in their foliage for perfect health, and, to the impartial observer, seemed to indicate the approach of yellows. Mr. Law did not seem to be at all discouraged; he has studied the peach business a good deal, and ought to succeed, if the manifold conditions of soil and climate can be fulfilled in Connecticut. He has invested a good deal of capital in his experiment, and has the apple trees to fall back on, if the peach trees fail. If the yellows could be eliminated from our nurseries, and nothing but sound peach trees could be sold, we should have more confidence in peach orchards in this latitude. The secret of the yellows will no doubt be discovered in due time.

P. M. Augur, the pomologist of the Board of Agriculture, has devoted much attention to this subject, and thinks much of the difficulty in raising peaches arises from hereditary disease. Fifty years ago the stocks were mostly propagated from the pits of healthy trees, and peaches were common in almost every garden. Now, with the greatly increased demand for the fruit in all our large cities, the greatest carelessness prevails in the propagation of the trees, which is almost universally by budding, and the laws of vegetable physiology are wholly ignored. The nurseryman very generally plants peach pits without much regard to the healthy condition of the trees upon which they grow. Both stock and bud should be taken from trees known to be sound. Our pomologist insists upon the following conditions in the propagation of this fruit, which we commend to the careful study of all cultivators.

1. Inherent good health in the trees.
2. Guarding against insect depredators.
3. Good careful cultivation of orchards, well located as to exposure and altitude, avoiding excessive growth, securing well-ripened wood, and well-developed fruit buds.
4. Feed the orchard regularly, moderately, and increase the fertilization as the orchard bears crops, so as not to allow soil exhaustion.
5. Be regular and systematic in thinning out the set of fruits; first to save the trees, second in order to treble its value from extra size and appearance.
6. As a matter of safety, mulch the trees in November, so as to retain the moderate freezing of winter in ground so mulched into spring sufficiently late to escape late frosts, and also in spring so as to prevent excessive evaporation during summer. With a well adapted soil and location, good healthy trees, proper cultivation and management, judicious pruning, proper thinning, a good

succession of the popular market varieties—conditions all within the power of man—we believe our climate, soil, and surroundings ample for the fullest success in raising the peach.

Storrs S. Cotton, in the south part of Pomfret, has got a little out of the beaten track of farming and thinks more money can be made from fruit than from the dairy. He is near several thrifty manufacturing villages, and not more than two or three hours from Boston and Providence. He has a young peach orchard, which looks healthy and vigorous. The varieties planted are the early and late Crawford, George the IV, Coolidge's Favorite, Gros Mignonne, Morris White, Foster, Stump the World, Honest John and Old Mixon. Strawberries do remarkably well, and the favorite varieties are Downing and Wilson's Albany. From one-third of an acre three thousand quarts were picked and sold for three hundred dollars, in 1878. This is very low, but considering the small amount of capital invested in land it must leave a better margin for profit than the old style farming, which hardly averages ten dollars an acre. He has also what is rarely met with, a plantation of the quince, which, in the cooked condition, is one of the most wholesome and appetizing of fruits.

CRANBERRY CULTURE.

Dr. G. Austin Bowen, on Woodstock Hill, has gone into the cultivation of cranberries, enough to demonstrate its profitableness under favorable conditions. His special pet is a plantation of six acres near the village, of which he is part owner. The preparation and planting was done some years ago while he was in the city, and cost much more than it would have done with his immediate supervision. The sand was a good deal mingled with loam, and was put on in some places to the depth of eight inches, adding much to the expense without any benefit. The expense of sanding and planting was about five hundred dollars to the acre. The excess of sand and its mixture with loam have checked the growth of the cranberries, while they have favored the growth of grass and weeds. In some parts of the plantation, the cranberry vines have made a good growth and produced bountifully. In the year 1877 one-third of an acre yielded thirty-three barrels, and the whole crop was one hundred and seventy-two barrels. The crop was sold in New York, for five and a half to six dollars per barrel. The product in 1878 was one hundred and fifteen barrels. The cost of picking was forty cents a bushel. This result, though encouraging, considering the age of the plantation, is not a very extravagant profit upon the capital invested. In the year 1880, something over two hundred and eighty barrels was reported from this plantation, which at six dollars would be worth one thousand six hundred and eighty dollars, from six acres of land. There are not a few swamps in Windham county, much more favorably situated than this of Dr. Bowen, where the planting could be much more cheaply done, and the crop be made more uniformly secure. The three prime requisites in making a cranberry plantation are a peat bog or swamp, adjacent sand or gravel banks, and capacity for flowage at the convenience of the owner. The plants are likely to be damaged in May by late frosts, in June by the worm, and the fruit by frosts in September. Water is a complete protection against both frosts and worms, and makes the crop in Connecticut about as sure as any other fruit. Near the sea coast flowage is less a necessity, as the sea air prevents frosts, both in May and September. The fruit is nearly full grown the first week in September, and by many cultivators is picked then. But the fruit does gain some in size and quality all through the month of September, and is of a much richer color, and commands a better price. Considering the limited area in which the cranberry can be made a secure crop, and the constantly growing demand for it both in this country and Europe, it is not probable that the production will outgrow the demand, or that prices will be much lower for years to come. Considering the market facilities of Windham county, the growing of almost all of the small fruits for the local markets is likely to prove a valuable adjunct to the dairy and variety farming that now prevails. Small beginnings are always desirable unless the cultivator has large experience gained in other fields. The local market whose wants are to be studied and supplied is always close by, and observation is easy.

FOREST CULTURE.

Among the best investments of the present and prospective farmers of Windham county, and of the whole state as well, will be those made in the preservation of our remaining forests, and in the planting of our hill-tops and mountains, and a portion of our worn-out lands, with timber trees. Very little attention has been paid to this matter in any part of our state, and there is no concerted plan for the preservation of our woodlands. The state Board of Agriculture, or some officers appointed by them, should have this matter in charge, and some general plan of forest culture should be adopted for the whole state. This would be an abridgement of personal liberty of course, and would be resisted, probably, by some of the less intelligent of our land holders. But there can be no doubt that the public good requires some restriction to be placed upon the wholesale destruction of our forests. At present there is no system of cutting off woodlands, and every one follows his own impulses in destroying the growth of former generations. The evils attending the destruction of forests are not well understood, and nothing but the personal convenience or necessities of the owner determines the destruction or preservation of our woodlands. There can be no doubt that we have reached the last limits of safety, if we have not already passed them, in denuding our soil of the splendid forests that once covered it. The necessities of our railroads are all the while encroaching upon them, and the cry for timber, to say nothing of fuel, is likely to grow more imperious as we increase in wealth and population. There is great peril in the not distant future from the neglect of forest culture, and the sooner we awake to it the better for the present and the coming generations.

Evils Attending the Destruction of the Forests.

Hon. George P. Marsh, in his great work entitled "Man and Nature," says, "There is good reason to believe that the surface of the habitable earth, in all the climates and regions which have been the abodes of dense and civilized populations, was, with few exceptions, already covered with a forest growth, when it first became the home of man. The present condition of some of the countries around the Mediterranean Sea, once among the most productive in the world, and sustaining immense population, is a good illustration of the ruin wrought by the removal of forests. If we compare the present physical condition of these countries, which once constituted a portion of the Roman Empire, with the descriptions that ancient historians and geographers have given of their fertility and general capability of ministering to human uses, we shall find that more than one-half of their whole extent, including the provinces most celebrated for the profusion and variety of their spontaneous and cultivated products, and for the wealth and social advancement of their inhabitants, is either deserted by civilized man, and surrendered to hopeless desolation, or at least greatly reduced, both in productiveness and population. Vast forests have disappeared from mountain spurs and ridges; the vegetable earth accumulated beneath the trees, by the decay of leaves and fallen trunks; the soil of the Alpine pastures, which skirted and indented the woods, and the mould of the upland fields are washed away; meadows once fertilized by irrigation, are waste and unproductive, because the cisterns and reservoirs, that supplied the ancient canals are broken, or the springs that fed them are dried up; rivers famous in history and song have shrunk to humble brooklets; the willows that ornamented and protected the banks of the lesser water-courses are gone, and the rivulets have ceased to exist as perennial currents, because the little water that finds its way into their old channels is evaporated by the droughts of summer or absorbed by the parched earth, before it reaches the lowlands; the beds of the brooks have widened into broad expanses of sand and gravel, over which, though in the hot season passed dry-shod, in winter sea-like torrents thunder; the entrances of navigable streams are obstructed by sand-bars; and harbors, once marts of an extensive commerce, are shoaled by the deposits of the rivers at whose mouths they lie."

This graphic picture of the ruin wrought by lack of system in husbandry, in the mightiest Empire of the old world, is only a prophecy of coming desolation upon our own soil, if we do not avoid these errors. The foot-prints of the destroyer are already visible in our waning forests, in our bleak and barren hill-side pastures, in our shriveling trout streams where the springs are nearly dry that once protected the fish in summer, in our water-courses, emptied of their treasures every summer, in our increasing droughts, stopping the mills upon the rivers, that once turned their wheels the year round, in the multiplying of reservoirs to catch the winter rains and hold them for summer use. These are indications that cannot be mistaken; and they ought to awaken our citizens to the remedy before it is too late. About one-fifth of our territory should be kept in forest, for the highest productiveness of the cleared lands. These woodlands should be located upon the hills and mountains, and especially about the sources of our brooks and rivulets, that feed the rivers. The swamps along the borders of these brooks should be kept in that sort of timber that rejoices in wet land—maple, elm, birch, ash, white cedar, and pine,—even if these swamps are drained they should be kept in forest, for the benefit of other parts of the farm. Every forest with its vast accumulation of leaves and mold holds water like a sponge, and distributes it gradually to the atmosphere, and to the springs that occur in its cool recesses—they make rains more frequent,—distribute the rain-fall of the year more equally, and forestall the terrible floods that sometimes come in summer after droughts, and do great damage to crops, stock, and fences upon intervale land. The great majority of farms in this country have some portion of their pastures that were better fenced in for forest, than kept in their present unproductive state. Now, these lands hardly pay taxes and interest upon their purchase price; planted with chestnut, larch, or pine, they would make a secure investment for the future, and in a few years the thinnings would be available for fuel, poles, and railroad ties. In a visit made to Woodstock two years ago, we remember to have seen a small tract of pasture-land grown up to white pine without artificial planting. There were but few old trees to furnish seed, yet the saplings in a period of fifteen or twenty years had taken full possession of the ground, and the owner was cutting from the dense growth valuable poles and rails for fencing. We have noticed occasionally in our travels in other parts of the state similar patches of white pine, taking possession of neglected pastures and growing so compactly as to destroy all undergrowth. This is one of our most valuable trees for lumber, and great account is made of it in Massachusetts for manufacturing boxes for the shoe trade, and other branches of industry. Anyone living upon the line of a railroad and watching the freight trains has occasion to wonder where all the lumber to make the boxes comes from. A visit to the eastern part of that commonwealth, where large tracts of poor land are given up to the growth of pine, would explain the mystery. Pine trees of a foot in diameter, the growth of the last twenty years, are largely used in this business, and the sawing of this lumber and the manufacture of the boxes is a profitable branch of industry.

So little attention has been paid to forest culture in this country that we shall have to look abroad for any reliable information concerning the profits of the business. The larch plantations of the Duke of Athol, in Scotland, were made upon land worth from nine-pence to one shilling per acre. At thirty years from planting the trees were thinned to four hundred per acre, which was considered the proper number to grow to a large size. The value at different ages was estimated as follows :

400 trees per acre at 30 years old, $375
400 " " " " 43 " " $2,250
400 " " " " 59 " " $10,000
400 " " " " 72 " " $15,000

It is not however necessary to wait thirty years to receive profit from the growth of a forest. Any woodland cleared in the winter begins to grow the following spring. Sprouts six to eight feet long start from the stumps of birch, ash, maple, oak and chestnut and hickory. In four or five years the thinnings make good hoop-poles, and the consumption of these by the coopers in our manufacturing towns and cities is very large. Some farmers who understand the business keep a portion of their woodland especially for the growth of hoop-poles, clearing the land every six or eight years. Others devote them to the growth of fuel and railroad ties, clearing them every twenty-five or thirty years. The wood for fuel pays fairly, delivered in the local market at five or six dollars a cord. The ties pay still better delivered at the nearest depot at fifty cents each. It is by no means certain that this is the most profitable use that can be made of the forest. If four hundred of the most thrifty trees to the acre were left to grow after the thinnings until sixty or seventy years old, the profits would be very large. The chestnut is well adapted to our soil and climate, is indigenous, grows rapidly, yields a valuable nut, and is among the best of our timber trees, highly prized for the frames of buildings, for furniture and for house finishing, for ship timber, for siding, for shingles, for fencing, and for almost all purposes for which lumber is used. A farmer could hardly leave a more secure and more profitable investment for his heirs than a twenty-acre wood lot with a vigorous growth of chestnut upon it, to be cut when sixty years old.

The European larch is better known in this country as an ornamental tree than in forest growth for lumber. It is, however, one of our most valuable timber trees, grows rapidly, and fertilizes the soil upon which it is planted. It is as well adapted to our soil and climate as the chestnut. When grown thickly, it affords long slender poles, which are useful for fencing and very durable ; it is also used for hop poles and fence stakes. Grown four feet apart, about two thousand seven hundred trees on an acre, the larch will in a few years become large enough for fence posts, and these are worth in our village and city markets from twenty-five to fifty cents apiece. The larch is, if the testimony of European writers may be received, more durable than the arbor-vitae. It grows quite rapidly and under favorable conditions will grow to thirty feet high and a foot in diameter in twelve years. A writer in *Scribner's Monthly* discusses the advantages of forest culture in the following forcible language:

"A world of mischief is already done in America, and now, of course, the question is 'What is the remedy?' The first answer is 'Stop destroying.' Wood must be cut, that is true, but it is not necessary to exterminate it unless the land is needed for cultivation. Timber must be felled for building and manufacturing purposes, but it is not necessary to denude the land and burn it over. Large tracts of undisturbed forest should be left, and then when the work of destruction has been perfected we must begin to plant forests and let them grow. The American is not a patient man. He is particularly desirous to see the result of his toils and his expenditures in his life time. To plant a forest which it will take fifty or sixty years to mature seems like throwing away life, but it is demonstrable that so good an investment for one's family cannot be made as an investment in the growth of a forest. Prof. Northrop quotes Dr. James Brown as saying that he has seen crops of larch of sixty-five years standing sold for from seven hundred to two thousand dollars per acre, from land that was only worth originally from two to four dollars an acre. It has been calculated by competent authority that a plantation of ten acres of European larch, to last fifty years, will produce a profit of thirteen per cent. per annum, and give a net profit of $52,282.75! Mr. Sargent, director of the Botanic Garden and Arboretum of Harvard College, calculates that there are two hundred thousand acres of unimproved land in Massachusetts, which could at once be covered with larch plantations, with advantage, and that if so planted their net yield in fifty years would be considerably more than a billion of dollars. Prof. Northrop advises the Connecticut farmers to plant white ash, but Gregor says, 'No tree is so valuable as the larch in its fertilizing effects, arising from the richness of its foliage, which it sheds annually. The yearly deposit is very great, and the leaves are not blown away by the wind, but remain upon the soil where they fall.'"

Farmers who want information for practical use should send to Mr. Northrop for his book. Bryant on Forest Trees is also a valuable work. Lands are various, and have their special adaptations to various kinds of trees. If a farmer have a sterile pasture, let him remember that the way to make it fruitful at the least expense, is to plant it with trees. Trees have a chemistry of their own for dissolving the elements of the rock, in the crevices of which they will grow. Spread a sterile pasture with shade and strew it with leaves every year, and a good piece of land will be made of it, for those who succeed the planter, while the crop of trees will pay all expenses, and leave a handsome profit. When we remember what a beautiful object a tree is, how important a part it plays in all our landscapes, how useful it is in all the economies of life, and how beneficial it is in climatic influences, we do not wonder at the zeal with which Prof. Northrop pushes its claims upon popular attention.

Not much has been done in Connecticut in the way of planting forest trees for fuel and lumber. The great labor of our fathers has been to clear away the forest and to prepare for cultivated fields. There has been little thought of the time when there would be too little woodland for the well-being of pasture and meadow. A visit to the farm of the late Luther D. Alexander gave us an example of what may be done with the white pine in forest culture. If there is anything more picturesque in Windham county than the country about Alexander's lake in the northwest part of Killingly, we do not remember to have seen it. As we come down from the Pomfret hills, the soil grows thinner, and after passing the Quinnebaug we come upon a light sandy loam, quite free from stone, and very easily worked with the plow and harrow. For this reason, probably, it has been cropped from the first settlement of the country until its fertility was well-nigh exhausted. The Alexander farm embraces about a thousand acres of this light soil, lying near the lake. We had heard much of his success in reclaiming this exhausted soil by the use of ashes, and also of his successful tree planting, especially the white pine. The most of the land was bought about fourteen years ago at a very low figure, and in poor condition. The shore of the lake, which is a beautiful sheet of water, was nearly stripped of its wood. The renovators employed have been mainly wood-ashes, buckwheat, and clover. The ashes have been bought up in the neighboring manufacturing villages and applied to the land at the rate of about seventy-five bushels to the acre the first year, and the same quantity the second year. Buckwheat has been sown very extensively for one or two crops in succession, and then the land has been stocked down to grass with a crop of oats. At the time of our visit about forty acres were in buckwheat, estimated to yield twenty bushels to the acre. The clover continues about two years, and then the red-top and herds-grass have the field. The large meadow on the north side of the lake had been in grass for nine years, and after so long a time without manure was in good heart and would cut over a ton to the acre. About three hundred tons of hay were cut from two hundred and fifty acres of land. The average price paid for ashes was about nineteen cents for dry ashes and fourteen for the leached. It is probably the most economical fertilizer that could be used for this kind of land.

The most of the forest culture has been around the east half of the lake. As some pine trees well grown were upon the land at the time of purchase, the seed-bed of the enterprise was already prepared, and possibly suggested the improvement. On parts of the shore nothing was needed but to keep out cattle to secure a rapid growth of the fine young pines springing up in every direction, and could be transplanted without much labor, and with no danger of drying the roots, which is so fatal in moving evergreens. Young trees were planted in vacant places and along the roadsides, about a rod apart, transforming a scene of barrenness and desolation into the most attractive drive in the town. As the owner's taste ran largely to the breeding of fine horses, a track was laid out upon the south side of the lake, where the speed of his colts could be tested. It has become quite a place of summer resort for picnics, and celebrations of various sorts; the æsthetic uses to which the plantation has been put do not detract at all from its financial value. It is a successful enterprise in forest culture, on a small scale. The young growth, in many places, is already much too thick for profit, and the thinnings would be valuable for fencing, or for poles, or for fuel. The trees planted by the road-side are a foot or more in diameter, and will soon require thinning. Aside from the additional charms the groves have added to the landscape, the investment has added much to the financial value of the place. Men of wealth and culture in our cities are seeking country homes far more than their fathers did, and are willing to pay for well-grown trees, and pleasant drives in the vicinity of their homes.

BREEDING SHORT HORNS.

Among the profitable branches of farm industry to be carried on in this county is that of raising thorough-bred and registered stock for the improvement of our neat cattle. From our location in the immediate neighborhood of a large manufacturing population, nothing can be more certain in the future than a largely increased demand for milk, butter, and beef, and better prices. The short-horns are the beef breed of cattle, and larger prices are obtained for registered stock, not only for Connecticut farms, but for the far west. There is a very large demand for bulls to run with the great herds of Texas cattle, that are bred in the great pastures of that State, and further north among the streams that feed the Arkansas, the Mississippi, and the Missouri rivers. This breed has left its stamp upon a large part of the cattle that now supply the beef markets of our eastern cities, and that are shipped in ever-increasing numbers across the Atlantic. There is hardly any limit in prospect to the demand for pure-bred short-horns to cross upon the coarse cattle that are now grazing in that great pasture that stretches along the eastern base of the Rocky Mountains for two thousand miles. Benjamin Sumner of Woodstock, is among the noted breeders of short-horns in this State. At the time of our visit, two years ago, he had forty-five head, led by Baron Hubback 2d. It was a pleasure to look at their broad loins and sleek sides as they grazed in the lush pastures, where a large crop of hay had been gathered in the early summer. We have no doubt at all about the skill of the owner in breeding, or the excellence of the animals with which he started in business, but what could he, or Booth himself, have done without these pastures, or others just as good? A short-horn must be of very thin blood that would not "wax fat and kick" voluptuously in such sweet fields as stretch away in green billows of grass in every direction from the farmhouse. Mr. Sumner has the mind of a lover among these princely creatures that graze his fields, and the appreciative listener can hear him talk "short-horn" by the hour, with no break in the thread of his discourse. Any man of taste who owns land is sure to leave this farm with the "short horn" fever upon him. Mr. Sumner cuts about one hundred and twenty-five tons of hay from fifty acres of mowing. He has several fields that have never been plowed since the country was settled. They are kept in a high state of productiveness by occasional top-dressing. He claims that his old sod, which has never been disturbed, yields a greater variety of grasses, and makes better feed, both in the dry and green state, than can be got from any soil with the usual rotation of crops. This is probably true of the rich moist soil of his farm.

It does not follow at all that this would be the best treatment for sandy or light, gravelly soils. The lands are probably the exception where this treatment would be advisable.

JERSEY CATTLE AND THEIR GRADES.

There must also be a great demand in all this region for purely bred and grade Jersey cattle, a demand that is beginning to be met in the Mashamoquet and other farms. The Jersey is pre-eminently the butter cow, and the grade Jersey the family cow. There are many people living in the villages, and their suburbs, who wish to keep one or two cows, just to supply the family with milk, butter, and cream, for the table. Where raising registered stock is not in view, the grade Jersey meets this want probably better than any other stock. The grades come much cheaper than the thorough-breds, generally yield more milk, which is sufficiently rich to meet any reasonable wants. Such cows take kindly to petting, and are sure to make a steady market for their kind, in coming years.

Charles W. Goodhue of Pomfret, keeps a herd of thorough-bred and registered Jersey, breeds the stock, and manufactures a strictly gilt-edged butter, which can be sold on its merits at 70 cents a pound. The farm affords an example of the successful application of business principles to the art of agriculture. He came into the possession of his farm about twelve years ago, a successful business man from the city, of liberal education, but without experience in the cultivation of the soil. Everything was run out in the way of grass; the whole place of 160 acres yielding only 35 tons of hay, and that of very poor quality. The buildings were dilapidated, and must be reconstructed or built anew, and the soil renovated; and to do this economically meant that the crops should pay the annual interest on the investment, with installments on the principal. Mr. Goodhue claims to have accomplished this, and to have now under his management a farm which pays six per cent. interest on $30,000, with more regularity, and with more security for value in the future, than any ordinary business investment in the city.

These are by no means all the branches of agricultural industry that are likely to be remunerative in Eastern Connecticut, but are such as occur to the writer, after the acquaintance of a life-time with the region, and the careful study of its capabilities in later years, as offering a reasonable prospect of successful business, and happy homes to all new comers who like rural life. The habits and tastes of some are so conformed to the city that they should never seek a life elsewhere. Others would prefer the greater simplicity and wider range of the country, if they could meet the reasonable wants of their families as well. To the robust man, trained to labor with small capital, tenant farming offers a reasonable reward for his skill and labor, and a fair prospect of competence and ownership in the soil, in the future. One who has capital and a fondness for rural pursuits can make for himself a pleasant home in almost any of the towns of Eastern Connecticut, and at the same time make investments in the soil as remunerative and as secure as in government bonds.

MIDDLESEX COUNTY.

BY P. M. AUGUR.

Middlesex county, as it name indicates, is a central county in the state, embracing fifteen towns, viz., Middletown, Portland, Chatham, Cromwell, Middlefield, Durham, Haddam, East Haddam, Killingworth, Chester, Clinton, Westbrook, Saybrook, Essex, and Old Saybrook.

The county, by the towns of Clinton, Westbrook, and Old Saybrook, borders on Long Island Sound for a distance of some fifteen miles, and the landings in those three towns afford good shipping points for the market of the great city New York; while ten of the fifteen towns border on the Connecticut river, a navigable stream, on which steamers ply every day during the open season to New York city and elsewhere; so that only three of the towns of the county lack water communication at their borders, viz., Middlefield, Durham, and Killingworth, and these are respectively only five, six, and seven miles from shipping points by water; while all the towns but one either have railroads passing through their borders or in close proximity.

The population of the county is, according to the recent census, 35,587 in total; 17,495 males, 18,092 females, 29,611 native, 6,976 foreign, 35,200 white, 387 colored.

General Characteristics.

The county is watered by the Connecticut river, which runs its entire length, from north to south, emptying into Long Island

Sound at Old Saybrook; this, with its numerous branches fed by abundant springs, supplies every part of the county, so that nearly every farm, and in some cases almost every field has its living water.

GEOLOGICAL FORMATION.

All the county except Middlefield, Cromwell, the west half of Portland, and the west half of Durham is a granite formation.

Middlefield is mostly red sandstone, but Higby and Beseck mountains on the west border are trap rock. Likewise the central part of Durham is red sandstone, and the mountains of the west are trap; while Cromwell and the west part of Portland are of very fine freestone. Middletown, excepting the eastern part, is red sandstone, skirted on the west by trap mountains.

The surface of the county is diversified, and abounds in most picturesque scenery. For the most part the county is hilly, with beautiful and fertile intervening valleys. In some towns, as Haddam and Killingworth, portions are rough and rocky, fit only for pasturage or timber growing, yet the arable land is for the most part of good fertility.

The soil generally through the county is fertile; there are no sand wastes. In the shore towns, Clinton, Saybrook, and Westbrook, there is much land in the very highest state of cultivation; so in the river towns, especially in the vicinity of the Connecticut, is land whose productiveness is remarkable. In the greater part of Middletown, Cromwell, and Portland, the land produces crops of hay, grain, fruit, vegetables, and tobacco, which would be considered extraordinary even in the fertile west; in Middlefield and portions of Durham, the hills are nearly all smooth, free from rocks, arable to the very summits, and produce tons of gilt-edged butter, with abundance of fruit and all farm and garden crops.

There are in Westbrook, Clinton, and Killingworth, cranberry meadows which have been fitted with much capital and labor, and which have been largely productive, and there are other meadows which could be made equally productive with the requisite investment.

MARKETS.

Middletown, Meriden, and New Britain open ready markets at good prices for all the northern towns in the county, while the factory villages all through the county call for fruit, butter, eggs, and all other truck and farm crops; and in addition to these there is the evening steamboat for New York, whereby the most tender fruits and any other freight reach their destination the following morning at dawn. These considerations show that good farm productions in any line can easily and quickly be converted into *cash at current rates.*

SOCIAL AND RELIGIOUS PRIVILEGES.

There are in Middlesex county sixty-two churches, or one to each 572 inhabitants. These are so distributed that each inhabitant of the county can easily attend Sabbath services, and usually the church of their choice. The population of the county are largely a church-going people, and have those moral and religious principles which go to give peace and quiet in communities, and make property secure, and good neighborly feeling. In connection with these churches are Sunday-schools, and some Sunday schools outside, in which the young and adult population have religious instruction.

There are in the county 122 schools, having 169 departments and employing 172 teachers. Many of these schools are of a high order, and some are the very best in the State.

The Morgan School in Clinton, the High School in Middletown, Brainard Academy in Haddam, Durham Academy in Durham, and the excellent graded schools in nearly all the centers of population, offer educational facilities which the people do and will prize. There are also a large number of town and district libraries, which afford great reading privileges to both young and old.

AGRICULTURAL AND LITERARY SOCIETIES.

There are in the county the Middlesex County Agricultural Society, Chester Agricultural Society, Clinton Agricultural Society, Killingworth Agricultural Society, also farmer's clubs in Middlefield, Clinton, Killingworth, and Chester. These societies have done much by diffusing information and in other ways to advance agriculture.

RURAL IMPROVEMENT.

Societies have been formed in several towns in the county for street ornamental tree planting, and also for the laying of sidewalks, &c. Great improvement has been the result, and individuals all over the county have caught the spirit so that thousands of trees are annually planted, sidewalks made, hills graded, roadsides cleared of rubbish, and a general home taste created.

THE FIELD PARKS.

The Messrs. Field, (David Dudley, Stephen J., Cyrus W., and Henry M. Field,) sons of David D. Field, D.D., of Haddam, out of loving hearts for the town of their birth, have at great expense fitted up two parks in the village of Old Haddam, which will ultimately be the pride and enjoyment of every citizen. One of these parks, just in the vicinity of Brainard Academy, has a summit on its center from which the observer gets a landscape view hardly surpassed in New England, embracing as it does the noble Connecticut for a long stretch; also beautiful hills and vales, with village and forest.

THE CAPABILITIES OF THE COUNTY FOR AGRICULTURAL IMPROVEMENT.

The shore-town farmers have an opportunity to supply themselves with kelp or seaweed, which is driven on their shores in great abundance during southerly winds. This, when composted, makes a most valuable fertilizer.

The menhaden fisheries also supply vast numbers of fish in their season, which are sold at low rates, and are eagerly taken by the farmers, making an active fertilizer, containing nitrogen and phosphoric acid in considerable quantities. But when the fish are used by the oil factories the residue or scrap is nearly as valuable as the entire fish, and is obtainable at lower prices.

Then again the salt marsh and Connecticut river meadows, the meadows of Salmon river, Hamonasset, Sabethe and Coginchaug rivers, with their thousands of acres of land, mostly subject to an annual overflow, yield heavy crops of grass, and need no manuring; these are of great value to thousands of farms in every town in the county, affording great supplies of forage and a great amount of vegetable matter for soil improvement, valuable also for mulching orchards, vineyards, and plantations of small fruits.

Then again the waters of Long Island Sound, and the navigable Connecticut allow most of the towns to obtain at easy prices and at low freight the stable manure of New York city and other cities, ashes from Canada via canal, Hudson and the sound, and any other fertilizers at the lowest rates. Enterprising farmers can, and do, in these various ways, add largely to the value and productiveness of their farms.

Crops Adapted to the County.

Grass is here, as elsewhere in New England, the leading crop, and the county is adapted to produce good crops of hay of excellent quality. From a glimpse at the census sheets of a single town (Middlefield) we find that the largest average farm yield per acre was 1 ton, 171 lbs. Suppose the average price to be $20 per ton (the highest price being $28), the average market value of the hay crop in the town referred to would be $21.71 per acre. So there is no doubt that the hay crop in the county is a paying crop to the farmer. And when all the farmers come to make two blades of grass grow where but one grew before it will be still better.

The hill pastures of Middlesex county have a reputation for producing the finest quality of milk, butter, beef (and mutton, except for dogs); but there is room for very great improvement. On the whole it is safe to estimate that an increase of the total grass yield of the county might be made of thirty per cent. with a judicious use of available resources.

Corn.—There is hardly a farm in the county that does not raise a successful crop of maize or Indian corn. A yield of one hundred bushels per acre of shelled corn is occasionally reached, and seventy-five bushels frequently. In Middlefield, according to last census, the highest average farm yield was eighty bushels per acre, while the average town yield was forty-six and seven-tenths bushels per acre. Beyond all question this shows that the corn crop of the town was a paying one. It was undoubtedly so all through the county; in some instances the stalks, when well cured and housed, have been regarded as worth for fodder all the cultivation cost. By freeing the land from rocks and all other obstructions, planting in straight rows, and depending mainly on horse culture, corn may undoubtedly be raised at thirty cts. per bushel in a good season; but the current price is more than twice that amount, so the farmer may usually feel quite safe in raising at least enough corn for *home consumption.*

POTATOES AND OTHER ROOT CROPS.

Potatoes, as surely as any crop the farmer raises, should have skill and culture adapted to their requirements. A good crop of potatoes is very profitable, while a poor crop is very unprofitable. As there is on nearly every farm in the county good potato land, this should *always be chosen*.

Suitable land, of good fertility, a suitable variety, and good management all through, will secure a good crop, as a rule, with few exceptions; but ill adapted land and slovenly management will, as a rule, without exception, give a loss.

According to Middlefield census, the highest farm yield was four hundred bushels per acre, the lowest forty bushels per acre. The town average one hundred and twenty-eight and one-tenth bushels per acre. Other towns may make a better average, but we have not been able to get the returns.

Onions on suitable land, particularly for the last year or two, have given paying crops. There is much land in the several towns of the county, especially the shore and river towns, well adapted either to onions or any other root crops. Mangolds, Swedish and English turnips, are good crops for stock, and are all easily raised in every town in the county.

OATS

often prove a very satisfactory crop. They are a valuable feed for any farm stock, and bring in market satisfactory prices. The highest yield in Middlefield was seventy bushels per acre. The average yield thirty-six and four-tenths bushels per acre.

Tobacco.—In Middlefield, the highest yield of tobacco was 2,180 lbs. per acre, lowest 1,400 lbs. per acre. Average yield 1,794 lbs. per acre.

Wheat.—In Middlefield, highest yield, thirty-four bushels per acre. Average, twenty-three bushels per acre.

Rye.—Average yield eighteen and four-tenths bushels. Highest twenty-six and two-thirds bushels per acre.

THE DAIRY.

Middlesex county pastures, with their luxuriant feed, afford excellent conditions for the dairy cow. Having examined the records of some Middlefield dairies, I find an excellent showing for the buttermaker.

George W. Cook, from five cows, sold 925 lbs. of butter and 300 qts. of milk; Dwight S. Coe, from six cows, made 1,250 lbs. of butter; S. E. Miller, from five cows, 1,000 lbs. of butter; Ichabod Miller, four cows, 800 lbs. of butter; R. E. Bailey, from one cow, 300 lbs. of butter; James Norton, from one cow, 300 lbs. of butter; Rev. S. D. Jewett, from one cow, 372 lbs. butter, and milk for the family; Michael Doyle, from one cow (per record), 408 lbs. butter. A. M. Bailey, for the year 1880, made something over 8,000 lbs. butter, all worked into one lb. stamps, and sold for extra prices; cows Jerseys and Jersey grades.

The dairy cows of Middlefield have been greatly improved by the choice selection of Jersey bulls, for several years past, so that they are very largely Jersey grades, and the butter is in demand, at good prices.

The following table was made up from the census schedules of the enumerator, before they were forwarded to the department, and shows the returns from fourteen of the leading farms in the town of Middlefield.

A few instances of farms yielding satisfactory profit will be given farther on, in other towns, as representative farms, many others being as good:

Farm.	Value.	Value of Farm Implements.	Live Stock.	Wages.	Fertilizers.	Total Expenses.	Extra Farm Products.	Income over cost of Wages, Fertilizers, and one-fifth of Farm Implements.
1	$7,000	$300	$1,000	$500	$300	$860	$2,000	$1,140
2	10,000	400	1,000	200	150	550	2,000	1,450
3	5,500	500	800	325	150	635	2,000	1,365
4	4,500	150	400	238	350	668	1,200	532
5	6,500	500	700	600	70	770	2,000	1,230
6	6,000	330	1,000	300	200	566	2,250	1,684
7	15,000	600	2,000	1,000	200	1,320	3,500	2,180
8	50,000	1,000	3,600	1,300	....	1,500	4,000	2,500
9	5,000	150	850	150	120	300	1,200	900
10	8,000	200	1,000	50	50	140	2,000	1,860
11	20,000	605	2,950	275	64	460	1,420	960
12	5,000	500	1,285	840	....	940	1,900	960
13	8,000	200	560	400	100	540	2,000	1,460
14	9,000	350	550	180	60	310	2,145	1,835

On the above fourteen farms were in the aggregate 678 hens, which laid 5,406 dozen eggs, or on an average about eight dozen to each hen. Coe and Crawford had from seventy hens 1,000 dozen eggs, or about fourteen dozen per hen per annum.

The right-hand column above shows the balance on the farms, and it appears that capital properly invested yields fair returns in agriculture in New England.

The year 1879, whose crops come into the above aggregate, was a barren one for orchards to a great extent, and the year 1880 an enormously fruitful one. The fourteen farms, with the fruit value of 1880 added, would show much greater returns. The two years together would give a fair average, but we have not the figures.

MINERAL RESOURCES OF THE COUNTY.

Granite, as has been mentioned, is found in most of the towns. This granite is for the most part coarse, yet in many localities it is found good enough for building purposes, and for foundations of houses, bridges, etc. In Haddam, and that part of Middletown called Maromas, gneiss is found of excellent quality, which is used to some extent for building, but more for fence posts, for city-flagging, curbing, and other purposes. The quarries being near the river, and being easily and cheaply worked, the stone can be sent by water to New York, Boston, Middletown, Hartford, and elsewhere.

In the southeasterly part of Middletown, and in Haddam, feldspar and mica are found in considerable quantities. Thousands of tons of feldspar have been, and can be, utilized in the manufacture of porcelain ware. This business has been followed at a profit, and the mineral is still abundant.

In Durham and Middlefield are quarries of red sandstone, which have been worked according to demand. On Powder Hill, in Middlefield, is a peculiar quarry of sandstone, distinctly stratified, and divided by joints, so that sections of several square yards come out in regular order, admirably adapted by their great strength and uniformity for walls, culverts, and for flagging. In this quarry, lines of fossil-bird tracks are found, wonderful for their distinctness and regularity.

In Chatham, at Greathill, is a mine, where smaltine or tin white cobalt is found; this is an arsenical ore of cobalt, and is found in gneiss, with copper-nickel. A considerable investment was made here many years since, and tons of the ore worked; but for several years past the mine has not been worked.

Near Connecticut river, at the Narrows or Connecticut Highlands, in Middletown, is a mine of galena or silver-lead. This was worked during the revolutionary war for its lead, and again about the years 1854 to 1856, for its silver; this ore is silver and lead, chemically combined, yielding considerable silver, as well as lead, but since the last-mentioned date the mine has not been worked, and the property is now rented for the use of the Connecticut Hospital for the Insane at Middletown.

Haddam is particularly noted, according to Dana, for having beryl, chrysoberyl, epidote, tourmaline, feldspar, anthophyllite, garnet, iolite, chlorophyllite, automolite, magnetic iron, adularia, apatite, columbite, white and yellow iron pyrites, molybdenite, allanite, and sulphuret of bismuth, but by far the most valuable mineral resources of the county are in the freestone quarries of Portland and Cromwell.

These quarries furnish almost inexhaustible quantities of stone, of the finest quality for building and for monumental purposes; it is of great durability, and is easily worked. Many vessels and hundreds of men and teams here find employment.

The quarries open a market for large quantities of hay and all farm produce, and may be reckoned among the most successful industries of the county. Their locations, right by the channel of the Connecticut river, where stone may be shipped direct to all the cities of our coast, and by the track of the Air-Line railroad, give great facilities for shipping stone to any part desired.

The Timber Crop, as Adapted to the County.

In all the towns of the county are considerable areas, that are specially adapted to the production of timber. When the country was first settled by Europeans, this county was mostly forest; there is a tendency even now for much of the rougher parts to revert back to forest again ; so that the planting with such woods as will in the shortest time make valuable timber is the most profitable use for this kind of land. Perhaps no variety of timber is more generally valuable, and quicker of growth than the chestnut. This timber is easily worked, is very durable, and specially adapted to most of the timber soil of the county. White ash, though forming no very large portion of our timber, is quite valuable, grows rapidly, and cool deep moist soil seems best adapted to its growth : the timber is white, shows the grain beautifully, and is valuable with wood of other colors in the finishing of rooms, and also for furniture ; it is also tough, elastic, and durable, and well adapted to carriage work. The seed ripens about October 1st, when it can be gathered and kept during winter in a sand-bed to be planted in early spring. The seed germinates well, the tree grows rapidly, is easily transplanted, and by only a little timely care the ash would become one of the most valuable trees of the county. The white oak, yellow oak, hickory, white pine, and perhaps the European larch, the sugar maple, and some other varieties might be profitably planted wherever there are vacant places in forest land. In every plat of timber a few bushels of white oak acorns and hickory nuts should be planted, so as to produce a crop of hoop-poles, which will do much to pay for the early care of the timber land. The great idea in connection with wood-land should be to produce the most valuable timber in proportion to cord-wood, having an eye to *timber* rather than to *fuel.*

Large tracts of land in Haddam, Killingworth, and other towns have recently been cleared of timber for market (largely for railroad sleepers or ties); the propriety of immediately planting all such tracts with a plenty of chestnuts, walnuts, and acorns can hardly be questioned. Instead of leaving the land to itself, take it in hand and give the best direction by putting in valuable timber in vacant places. The crop that would accrue would be, from ten to fifteen years, hoop-poles, thence to twenty-five years telegraph and fence poles, thence to the end valuable timber. In this connection I desire to call attention to the following act of the Connecticut General Assembly in 1877:

> "Whosoever shall plant any land in this State, not heretofore woodland (the actual value of which at the time of planting does not exceed fifteen dollars per acre), to timber trees of any of the following kinds, to wit: chestnut, hickory, ash, white oak, sugar maple, European larch, white pine, or spruce, a number not less than twelve hundred to the acre; and after such plantation of trees shall have grown on an average six feet in hight, the owner of such plantation of trees may appear before the Board of Relief in any town in which such plantations of trees may be located, and, on proving the herein-mentioned conditions, such plantations of trees shall be subject to exemption from all taxation whatever, for a period of ten years next thereafter."

SHEEP.

The interest in sheep in the county is increasing, and justly so, for the hill towns are well adapted for sheep.

The farm of David Lyman's sons in 1880 carried 450 head of sheep. The yield of wool was 2,000 lbs. in May, or an average of $4\frac{44}{100}$ lbs. per head, which at 33 cts. per pound amounted to $660.

The lambs, 250 (an unusually low number for the farm) at an average of $4 per head, returned $1,000, making the cash return from the flock $1,660. The farm is highly productive in other respects (gross proceeds, $4,000). The late Henry Lyman (a deceased brother,) often quoted the maxim, "The tread of the sheep is golden."

The Lyman Brothers feel that the sheep are of great utility in running out briers, the ox-eye daisy, the wild carrot and other foul plants.

Another successful flock of sheep is found on the farm of Robert P. Hubbard, owned by himself and brother in Middletown, West Long Hill District. The flock consists of fifty choice sheep, yielding fifty lambs, sold at an average of $5 per head, $250; 325 lbs. wool, $6\frac{56}{100}$ lbs. per head, at 30 cts., amounted to $97.50, making a total yield from the flock of fifty sheep in cash, of $347.50, or an average per head of $6.95.

Yield of farm from sheep, - - - -	$347.50
Yield of farm from hay and straw, - - -	400.00
Yield of farm from tobacco, 5 tons, at 18 cts., -	1,800.00
Yield of farm, 75 bushels of wheat, at 1.10, - -	82.50
Yield of farm, 52 bushels of rye, at 80 cts., - -	41.60
Yield of poultry, - - - -	200.00
Yield of 1,400 lbs. pork, - - - -	74.00
Yield of garden truck, - - - -	65.00
Total proceeds, - - - -	$3,010.60
Expenses, - - - - -	1,420.00
Net returns, - - - - -	$2,590.60

In connection with this subject it ought to be remarked, and well remembered, that the great decline in sheep husbandry is owing to damage by dogs; were it not from fear of such damage, many times more sheep would be kept. The present dog-law, if it could be kept intact, would do much toward encouraging the keeping of sheep, so profitable as they certainly are. There are flocks here and there all over the country. Ordinary grade sheep, when coupled with a pure Southdown, or Hampshiredown buck, will produce lambs of great excellence, as illustrated in these cases.

Fences four feet in hight, surmounted by a wire eight inches within the line of fence, and slightly above, may be considered secure; a barbed wire as above, outside, *dog proof.*

POULTRY ON THE FARM.

Whitney P. Clark of Durham Center, owns and occupies a farm in the south part of the town of Durham. The farm is not above medium in fertility, but is shut in by hills on all sides except a narrow opening northwardly. A stream passes through the farm and an abundant spring gives ample supply to house and buildings. Mr. Clark has near his dwelling a large enclosure with small buildings for hens. The number kept in 1880 was 350.

The average cost per hen for keeping, is seventy-five cents per annum,	$262.50
Eggs sold amounted to,	512.00
Chickens amounted to,	100.00
Total,	$612.00

Mr. Clark has found, by trial, that the manure of one hundred hens as he has saved it, equals in results on crops two tons of fish scrap, which at last year's prices, $17 per ton, would make the manure of his stock of hens equal in value to $119. This added to the net cash proceeds, $612; manure, $119; makes a total of $731.

Mr. Clark mixes about an equal amount of sand with the manure, which after thorough working together he spreads broadcast on land, bringing splendid crops wherever applied. One hundred hens he thinks will fertilize two acres of land *well*. He uses a variety of feed, adopting wheat largely, which he thinks most conducive to egg-production. He has increased his flock so that at present time he has 550 hens. This like all other specialties needs special care and skill.

A special business in eggs is carried on by J. Cowan, on his farm in East Long Hill district, Middletown. He keeps in round numbers about 1,000 hens, largely white and brown leghorns. A look over his flocks of fowls is a sight long to be remembered. Mr. Cowan feeds *wheat largely*, occasionally buying a car-load. Estimating the cost of feed at seventy-five cents per head, the cost of the flock would be $750 per annum; 9,000 doz. eggs is an approximate estimate of his yield, he not having exact figures, however, from what we learned from him, and his man, we think the yield often exceeds that number, running up to thirty and sometimes to forty-seven dozen per day. Nine thousand dozen at twenty cents per dozen amounts to $1,800 per annum, not reckoning chickens or dressed poultry. The manure, reckoning on Mr. Clark's basis, would equal $340, or a gross amount equal to $2,100, from the single item of poultry. Considering the large amount of highly-concentrated nitrogenous manure thus made on the farm, production of good farm crops may be safely counted on anywhere that those thousand hens do not scratch or feed. One thousand hens in a plum or peach orchard clearing out the curculio and other insects, up to the ripening period and then removed; what a noble work they might do!

We consider, from these and other instances of known success, which we will not here introduce, that barn-yard fowls can be kept in large or small numbers in Middlesex county, or elsewhere, and always, with good management, yield a commensurate profit. Geese and turkeys in certain localities yield also a handsome return.

THE FARM OF TITUS HALE OF GILDERSLEEVE'S LANDING.

This farm is situated on the east shore of Connecticut river, in the northern part of Portland, and is valued at $19,500. The underlying rock here is freestone, soil strong, free from stone, and easily worked.

Value of live stock,	$1,500.00
Farm implements,	425.00
One-fifth of farm implements,	85.00
Manures bought,	800.00
Wages paid,	1,415.00
Taxes,	225.00
Running expenses,	$2,515.00

Value of Farm Crops.

Hay sold,	$400.00
Growth and increase of stock,	300.00
Butter and milk,	420.00
Pork and poultry,	149.50
10½ tons of tobacco, at 15 cts.,	3,150.00
Apples,	50.00
Potatoes, 150 bushels,	90.00
Total gross receipts,	$4,559.50
Less running expenses,	2,515.00
Net returns,	$2,044.50

We judge by the liberal application of manures on this farm, that it must be increasing in value from year to year. These examples of high farming verify the maxim "Feed your farm and your farm will feed you." They also show that it is not wise to undertake to run a farm without capital. We may make full deposits in *Nature's bank*, but she acknowledges *no counterfeit*. We must enrich with good material if we expect commensurate returns.

FARM OF C. C. & F. W. GOODRICH.

This farm is situated on the east shore of Connecticut river, in the town of Portland, one of the northern towns of Middlesex county. The farm has for the most part a northwesterly exposure; the underlying rock is the noted Portland freestone; the soil is a strong loam, and is of good natural fertility and quite free from stone, and is worked with comparative ease.

The estimated value of the farm is $15,000; live stock, $700; farm implements, $1,000. In addition to the manure made on the farm, a barge load of one hundred cords of New York stable manure, costing $700, was used on the farm. (This New York manure is from grain-fed horses, free from straw, unexposed to weather, and in that state warranted to weigh 4,480 pounds per cord.) This manure Messrs. Goodrich think the cheapest fertilizer that can be applied to either onions or tobacco. The amount paid for wages during the year, for both year and day men, is in total $1,500; extra feed bought for farm use, $200; taxes and insurance, $200. Making (including $200 wear and damage on farm implements) a total of running expenses, $2,800.

The year's returns were as follows:

Hay sold,	$1,500
Rye, 200 bushels, at 90 cts.,	180
Corn, 200 bushels, at 60 cts.,	120
Oats, 200 bushels, at 50 cts.,	100
Onions, 3 acres, 1,500 bushels, at 80 cts.,	1,200
Potatoes, 800 bushels, at 60 cts.,	480
Tobacco, 12 acres, 20,000 lbs., at 15 cts.,	3,000
Orchard products,	170
Pork and poultry,	135
Tobacco plants,	50
The total product as we find it,	$6,935
Running expenses,	2,800
Total balance in favor of farm,	$4,135

Estimating farm and buildings, -	$15,000
Live stock, - - - -	700
Working implements, - -	1,000
Running expenses, - - -	2,800
Total capital, - - -	$19,500

Now out of the farm balance of $4,135 take $1,000 for superintending, allow $135 for little incidental expenses, and there is left a net amount of $3,000, or about 15 per cent. on all the capital invested in the business.

Apple and pear trees on this farm have shown a wonderful productiveness. So also have quinces, and the small fruits.

FRUIT FARM AND NURSERY.

On the highland of Spring Grove farm, at the foot of Higby mountain, in Middlefield, are the orchards, vineyards, strawberry, raspberry, and blackberry plats, and the nurseries of P. M. Augur & Sons. Mr. Augur, senior, the State pomologist, has made fruits and ornamentals a study from boyhood. The sons are doing the same; natural taste, long experience, an orchard and vineyard test of new fruits as they are offered, gives them a knowledge of the practical value of fruits and trees, of which all may freely avail themselves by a personal visit, or by writing.

Their trees are found in orchards in every town in the county; also in various sections of the State, the United States, Canada, and elsewhere.

By choosing the proper season, they are ready to guarantee safe delivery, in good order, to any portions of the earth accessible by regular steam navigation, or railway.

In conclusion, I desire to say that in Middlesex county, where farms can be found, a judicious investment of capital under good management must be a safe and paying one. All the products of her climate, including all our fruits, are here raised with reasonable success. The air and water are excellent, health and longevity remarkable in the country towns; the mortality in Middlefield for the census year was only one-half of one per cent., and the opportunities for the physical, mental, and moral development of youth are excellent.

A man of good judgment, good health, frugal habits, industrious and persevering, and with a family to match, may engage in Connecticut farming with a prospect of success. But extravagant and useless expenditures, in any direction, should not be tolerated on the farm. There have been scores of failures in any other business where there has been one in farming.

Middlesex county with her fertile soil, her beautiful scenery, her excellent schools and churches, her good markets, and facilities for reaching them, still offers happy homes to intelligent men who wish to preserve their families intact from the evils of city life.

NOTE.

The omission in this sketch of the agriculture of Connecticut of any notice of three counties, New Haven, Litchfield, and Tolland, requires an explanation. It is simply this. Those parties employed to prepare sketches of these failed to fulfil their engagements. The other counties offer as good advantages for agricultural enterprize as those which are noticed; county lines are arbitrary divisions; while each county has its peculiarities, a general similarity pervades the state. We have a fertile soil, the best markets, good water, and a healthy climate. Fruit, both wild and cultivated, abounds, and what is said of the Connecticut river in the old couplet is truly descriptive of our rural scenery:

"No watery glades through richer valleys shine,
Nor drinks the sea a lovelier wave than thine."

FACTS AND FALLACIES IN VETERINARY SCIENCE, OR WHAT THE FARMERS SHOULD KNOW ABOUT DISEASES OF ANIMALS.

BY NOAH CRESSY, M.D., V.S., PH.D., HARTFORD, CONN.

In every department of physical science, there are certain facts which underlie all possible deductions. Every conclusion, therefore, worthy of scientific recognition, must be based on said facts, and serve as an explanation of them. Accordingly an accepted theory, among scientific men, is but the rightful interpretation of all existing facts in relation to the subject. Astronomy, chemistry, and biology are teeming with illustrations of such established principles. All of which, however, differ in a marked degree from an *hypothesis* that is based upon mere assumptions, and therefore often found to be fallacious on further investigations. Consequently a *fallacy* is a deceptive conclusion, drawn from the imagination of its author.

Nowhere are faulty methods of reasoning more frequently met with than in the practice of the Healing Art; and this is largely due to the system of education by which the votaries have thus attempted to fit themselves for this ennobling work. In fact the difference between a true and empirical method of curing disease depends wholly upon the degree of intelligence which the practitioner may possess. If the physician has all the necessary facts in relation to the anatomy and pathology of the malady in question, the therapeutical indications are easy of conception, and this treatment, therefore, is practically the result of a scientific conclusion. But the quack, whose scanty knowledge of disease rarely enables him to distinguish one ailment from another, can never give an intelligent reason why he uses a certain remedy, or what effect it may produce. Hence a system of practice, either in human or veterinary medicine, which is not based upon the established principles of biological science, is fallacious in theory and dangerous in its consequences.

The crude notions of disease, so frequently exemplified in the practice of the uneducated farrier, are almost invariably the gift of a fertile imagination, rather than the result of any pathological investigations. It therefore behooves us in the study of the Veterinary Art, to lay broad the foundation of knowledge, and thus inquire into the real nature and cause of the malady, before searching the materia medica for a cure. This will require a general knowledge of structure and of the anatomical relations of parts, before any facts, in a pathological point of view, can have the slightest bearing on the question of treatment. For instance, how can a farrier diagnose and successfully treat a case of pneumonia, in its various stages, who has no knowledge of the real structure of the lungs nor of the circulation of the blood. Hence, the importance of

COMPARATIVE ANATOMY.

A general knowledge of the mechanism and physiology of the animal body is absolutely essential for the discrimination of disease. The location and phenomena of symptoms cannot be accurately interpreted without an intimate acquaintance with the structure and functions of the internal organs. A case of acute nephritis, therefore, might easily be mistaken for an inflammation of other abdominal viscera. All these maladies would appear mysterious, and to the uneducated eye, essentially the same. In fact those characteristic symptoms of specific and organic disease would have no meaning to one not familiar with the general organism.

Much quackery would cease, and many fallacies concerning the nature and seat of disease must inevitably be dispelled from the public mind by the general diffusion of anatomical knowledge.

The comparative relations of the joints and parts of animals, to those of man, are not well understood, especially, by those most interested in the care of stock. This want of knowledge has, many times, led to fallacious conclusions, which have served as a barrier in the pathway of veterinary progress. But the popular demand for those practical facts which a knowledge of anatomy alone can give, are propitious omens in the canopy of our profession, and thus indicate the future trend of all such needed inquiries.

The relation of. man to the higher mammalia, which has caused so much speculation among philosophers and naturalists on certain zoological affinities, is especially interesting and instructive in an anatomical point of view. The skeletal framework and internal organization of our domestic animals are morphologically identical with the structure of the human body, and thus subserve the same purpose in the animal economy. The limbs are similar in mechanical design, are made up of the same kind of bones and joints, and are therefore subject to analogous diseases from exposure and accidents. Hence the necessity of more carefully studying the structure of animals, that we may better understand the nature and situation of the difficulty in every creature that we are called upon to relieve. This leads us therefore very naturally to inquire into the

HOMOLOGY OF BONES AND JOINTS.

Though all vertebrate animals are built upon the same general plan of structure, yet we find a modification of this plan in the four great classes known as fishes, reptiles, birds, and mammals, o fit them for their several spheres in life.* But the special details of structure on which genera are founded are well illustrated by the variety of form in the limbs of quadrupeds.

In all animals which crop their forage from the ground, and thus use the legs simply as pedestals, have no necessity for that power of rotation in the fore arm, which man and carnivorous animals possess in such a marked degree, as organs of prehension. The radius and ulna therefore have grown together, in accordance with nature's law of economy and strength, both in the horse and in all animals that chew their cud. This anatomical fact has enabled the geologist to predict the herbivorous character of a fossil species from a single bone. But in the hog these bones are not united, yet they are so closely adjusted that the power of pronation and supernation has been lost.

The cannon bone of ruminants furnish another very interesting fact, and one that is of equal importance to the paleontologist in determining the character of a fossil animal. This round bone of the leg, unlike any other in the animal kingdom, contains two marrow cavities which result from the union of the third and fourth metacarpal bones in the anterior extremity, and of the metatarsals behind. This is indicated by the double articulation which it makes with the two phalangial rows, contained in the claws of the divided hoof. In the embryonic stages the cannon bone readily divides into its two component parts, but at birth they cannot be separated in any of the ruminating animals. In swine, however, these two corresponding bones do not unite, though always in close contact with each other.

Accordingly the forward foot of the hog represents a human hand, with the exception of a thumb. The two toes, therefore, which these animals and all others with a divided hoof walk upon, correspond to our middle and ring fingers, and the bones in the dew-claws represent the index and little finger.

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* See Maclise's Comparative Osteology, or the Marphology of the Vertebrate Skeleton, illustrated folio, London, 1847.

In the horse, however, the cannon bone is single, and has but one toe, which represents the middle phalangial row of the human hand. Morphologically the nail is the hoof, and the three bones of the finger are known by the veterinarian as the coffin, coronet, and pastern. The larger knuckle of the hand, therefore, is the fetter-lock joint of the horse, and the wrist the forward knee. The elbow is represented by that projecting point, on the back of the leg, close to the chest, where "shoe-balls" occur.

The hind leg also, has some peculiarities in its mechanism that become very interesting points in the treatment of disease. The hock-joint, which is delicately constructed, and so frequently the seat of lameness from a sprain, answers in an anatomical point of view to the instep of man, though its relative position to the ground has been very much changed.* In view, therefore, of the comparative relations of limbs, we shall find, much to the surprise of the casual observer, that the stifle-joint corresponds, in every particular, with the human knee, and consequently the stifle bone, so often dislocated by accident, is the homologue of the patella or knee-pan. The necessity, therefore, of a thorough knowledge of these anatomical facts to aid one in the diagnosis and proper treatment of those obscure joint difficulties, is now apparent to all, and its importance cannot be over-estimated in behalf of a scientific practice in this department of the Healing Art.

DENTITION OF DOMESTIC ANIMALS.

The teeth belong to the digestive system, and though firm, hard substances, and even implanted in the maxillary bones, yet they are no part of the osseous skeleton. They are developed from the mucous membrane along the walls of the anterior portion of the alimentary canal, and thus serve as the mechanical agents in the division and preparation of the food. The teeth, therefore, are adapted in the carnivorous animals for seizing and tearing flesh; while in the herbivora, they are modified to suit the changed condition of the creature. In fact, almost every conceivable gradation of purpose may be served by these important organs in the economy of the different orders, genera, and species of mammals.

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* See Owen On Nature of Limbs, 8vo, London, 1849.

In the walrus, or sea-cow, we find a pair of tushes developed to such an extent that they are used as organs of locomotion when the animal is basking upon the shore; and the fossil dinotherium of the tertiary epoch evidently used a similar pair of front teeth on the lower jaw, as a means of anchorage.

The beaver, like the carpenter with his tools, diligently applies his gnawing teeth to the wood, and thus prepares, and by the same means transports the building material for his dam.

The elephant and the musk-deer have well developed teeth, that are employed as weapons of defence, while the hyena and the dog show their glistening ivory when in rage, and use the same as weapons of combat.

Nowhere is the secondary use of the teeth more evidently displayed than in man, where they not only contribute to beauty, but to his inimitable power of speech.

Hence, the teeth are important in a zoölogical point of view, and greatly aid in the classification of animals.* So intimate are the relations of these organs to the general economy and habits of an individual, that the naturalist is often enabled to determine the position of a fossil creature, in the scale of being, by the teeth alone; and not unfrequently these are the only relics to be found to mark the existence of some huge monster, whose skeleton has mouldered back to dust.

These organs are composed of three distinct anatomical elements, known as the dentine, the enamel, and the crusta-petrosa. The first was so named by Prof. Owen of London, in 1835.† It forms the bulk of the tooth, and is very firm and solid; hence it has been called the bone of the tooth. A modified form of it, as seen in the tusk of the elephant, is called *ivory*. It is made up of a series of minute tubes and cells, with earthy particles interposed. The dentine of the higher mammals is unvascular, but its nutrition is carried on by means of these tubes connecting with the pulp.

The enamel is the hardest substance in the animal body, and consists of earthy matter deposited in an organized matrix. It forms a perfect sheath around the dentine, except in the lower portion of the root. In man and the carnivorous animals, it permanently covers the crown, but in the herbivora, where the teeth are long and gradually wear away, it soon becomes denuded. Here it takes on a new form, being folded upon itself, and in the grinding-teeth, it presents a peculiar appearance, interspersed with dentine. In the front teeth of the horse it forms a deep cavity, known as the infundibulum, or "the mark" so frequently alluded to by veterinarians, in determining the age of an animal.

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* For further details consult article on *Teeth* in Cyc. Anat. & Phys., vol. 4th, London, 1852.

† Transactions of Zoölogical Society.

The crusta-petrosa is a hard bone-like substance, which covers that portion of the teeth within the jaw. In its structure and manner of growth it resembles the osseous tissue more than either of the dental elements. It varies greatly in quantity on different teeth, and is not uniform on different parts of the same tooth. It is the thickest at the end of the fang; and where it covers the enamel it appears like a thin layer of cement, which name also has been applied to it by various authors. This fills the bottom of the infundibula, and forms an oval island in the sack of the enamel, which is well seen in comparing the "marks" of five, six, and seven year old horses. As the teeth wear away the nerve begins to recede from the crown, and this cavity also is filled with cement, which makes the "dental star" in the lower incisors, at about twelve years of age.

There is a great variety in the form and number of teeth in different animals, and in all cases, there seems to be a special adaptation to their use in nature. The relation therefore that one kind of dentition holds to another becomes exceedingly interesting, especially as we review the order of succession, and thus endeavor to explain upon zoölogical principles

THE ORIGIN OF "WOLF-TEETH."

Naturalists are agreed that the typical set of mammalian teeth are forty-four, and these anatomists have divided into four distinct series. The front teeth, on account of their nearly uniform shape in all animals, have been designated the *incisors*, and vary in number from two to six; the next in order backward, are the *canines*, or bridle-teeth of the horse; then comes the four *premolars*, and lastly the three *molars*, as here represented:

Incisors, $\frac{3}{3}+\frac{3}{3}$; canine, $\frac{1}{1}+\frac{1}{1}$ premolars, $\frac{4}{4}+\frac{4}{4}$; molars, $\frac{3}{3}+\frac{3}{3}=44$.

This formula represents the teeth equally divided above and below, and upon the right and left side. But all animals do not possess this number. Man has only thirty-two, and comparing them with the typical set, we find that the outer incisors in both jaws are lost, the canines are in place, and so are the molars, but of the premolars, only two are present, and these are known as the bicuspids.

In the horse and ruminants we find the molars and three of the premolars, making the six grinders, present; and not unfrequently the first milk-molar in a rudimentary form, which may be called a *supernumerary*, or better known among horse-men as the "wolf tooth." These are always present as germs, at least in the lower jaw, and sometimes developed there, but almost invariably to be seen on the upper-jaw, just in front of the grinders, as shown in the following diagram of the deciduous teeth of the horse, ox, and sheep and swine.

Incisors, $\frac{3}{3}+\frac{3}{3}$; canine, $\frac{1}{1}+\frac{1}{1}$; molars, $\frac{4}{4}+\frac{4}{4}=32$.

By comparing these two formulas we perceive that the permanent incisors and canines replace the corresponding milk-teeth, and that the second, third, and fourth premolars take the place of the deciduous molars, so called. The first milk-molar is not numerically replaced by the second growth of teeth, inasmuch as there are but three premolars in any living animal; though Prof. Owen claims that the hog has a complete set. But there is evidently some mistake about the dentition of the *Suidae*, as I shall endeavor to show further on.*

This peculiar denticle which horse-jockeys claim is the cause of sore eyes, blindness, and other ophthalmic troubles, is simply an unshed milk-tooth, always to be seen in the colt's mouth, and not unfrequently in the full-grown horse. The occasional presence, therefore, of this diminutive tooth, with the permanent set, only illustrates the law of reversion, and should be looked upon in a zoölogical, rather than in a pathological point of view.

Professor Leidy of Philadelphia has found in his well known osteological researches concerning the extinct mammalian fauna of Dakota and Nebraska, that the Anchitheridan family of solipeds, now found fossil in the *Mauvaises Terres*, had a similar dentition to the horse; thus showing that this noble animal, in its paleontological lineage antedates the lapse of historic time. Hence the wolf-tooth becomes an interesting relic in the study of natural history. The various diseases of the eye, therefore supposed to be caused by this nerveless tooth, must have prevailed throughout a long geological period, before the advent of man or the introduction of the dental art.

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* See Owen's Odontography, London, 1845.

It is not a little singular that the farriers of this country, who almost invariably claim to have found this dental rudiment so very troublesome in the horse, have not paused in their pretended search for facts, to inquire whether similar diseases did not exist in other domestic animals, where these wolf-teeth were quite as prevalent.

In swine the first decidous molar is well developed, and occupies a medium place between the tusk and the second premolar of the permanent set. It is always present in our fattened pigs, but rarely found in the wild hog, on account of their voracious habits in obtaining food, by which means these tenderly-rooted teeth soon release their hold. Seeing a difference in dentition, therefore, in the adult animal, Cuvier was led in his classification to separate the domesticated varieties from the feral species. This observation, however, was soon corrected by other naturalists, and the hog is now looked upon as the only animal in existence that has a typical set of forty-four teeth. But this conclusion is fallacious, and its elucidation will throw new light on the "wolf-tooth" question.

According to the typical formula of deciduous teeth, swine, horses, ruminants, and dogs have a complete set, or their corresponding germs. All these, when developed, are displaced by those of the permanent set, except the first molar on each side, above and below. The second, third, and fourth premolars, therefore, take the place of the last three milk molars; and in no existing animal is the first premolar present, but it has been found in the Elotherium and other fossil mammals. Consequently the so-called "wolf-teeth" exist, for a while, in every animal that had a complete set of deciduous molars.

The hog, therefore, has not a typical number of teeth as naturalists have claimed, but, like the horse, has only forty in the second dentition. Though the shoat has forty-four in his mouth at a given time, yet the four small ones back of the tusks are milk teeth that have not been shed, and are in every respect homologous with those noted ones in the horse, and would bear the same relations in position with the grinders were the premolars in the hog as well developed. In the two-year-old colt these denticles are always to be found, especially on the upper jaw, and not unfrequently in the lower one, or the germs are there, the same as in calves and lambs.

Thus we perceive that these wolf-teeth have a wide zoological range; and as there is no reason upon anatomical grounds why they should be more troublesome in one animal than another, let us now review in detail some of the more salient points in their supposed

PATHOLOGICAL SIGNIFICANCE.

At an early age in veterinary lore, when the diseases of the eye were but imperfectly understood, the farriers, for want of real knowledge on the subject, were led to attribute this frequent ophthalmic phenomena to some strange cause. The presence, therefore, of these diminutive teeth in the mouth of an afflicted animal that were of no conceivable use whatever, caused them to be looked upon with not a little curiosity. They sought an explanation of this seemingly dental freak of nature, but their limited knowledge of anatomy gave no clue to the mystery. These teeth were frequently met with as an accompaniment of periodic ophthalmia and other forms of sore eyes, and, believing that nothing was ever made in vain, they at last conceived that these worthless denticles were the real cause of the trouble.

Accordingly this view of the subject has been handed down with increasing confidence, from one generation of horsemen to another, without ever stopping to inquire into the nature of the malady in question, or the imaginary facts upon which this theory was founded. Hence it is not strange that a horse in this country is now rarely purchased without first examining the mouth for wolf-teeth, from fear that the animal sooner or later may become blind. But the horse-jockey is not alone in this delusion. Members of the regular medical profession, and not a few professed veterinarians, have lent their influence in this direction, until it has become the popular belief throughout the length and breadth of our land.

Now what are the facts which would seem to justify such an erroneous conclusion; and why have not rational men seen this fallacy long ago, and thus sought a real explanation of the matter? There can be no excuse for such a course, and this lamentable ignorance among our people only illustrates the importance of a better system of education for the sons of the soil, in every state where stock-raising has become the leading traffic.

Hence I have felt it my duty, on every occasion for the last ten years, to protest against this system of quackery, but thus far I have found but little assistance among educated men; and this is why I have thus attempted to call public attention to the subject, in hopes that the facts in the case may be better understood.

As every colt has a pair of wolf-teeth on the upper jaw, a large majority of which are shed with the milk molars, at three years of age, it is therefore evident that only a small proportion of horses could ever be troubled with this peculiar form of blindness. But this is not the case. All horses are subject to occasional attacks of sore eyes, whether they have these wolf-teeth or not; and if these wonderful teeth are not the cause of at least nine-tenths of the cases that occur, why need we suppose that the remainder are in any way attributable to the presence of these dental rudiments in the jaw, when the history, symptoms, and necessary treatment in a given number of cases are all the same.

Furthermore, an acute inflammation of the membranes of the eye is often of an epizootic character, periodic in its invasions, and thus attacks a large number of animals at once. It accordingly comes and goes with the seasons, and the degree of severity is not so much due to the condition of the horse as it is to the amount of exposure, and the inclemency of the weather, for an animal in any condition is liable to become involved in such a distemper. Hence I trust all will admit that the cause in question is atmospheric, rather than of dental origin.

If wolf-teeth are ever the efficient cause, the trouble should be permanent, unless they are at once removed. But as the majority of these cases are of short duration, and readily yield to treatment, regardless of the teeth, we cannot therefore ascribe any very marvelous cure to their accidental removal. Consequently we should expect to find all wolf-teeth associated with some chronic disease of the eye, like cataract, but unfortunately for the argument this is not the case, as many old horses still retain them and have perfect vision. On the other hand, many cases of the opacity of the lense have occurred where no such dental cause could be found.

Accordingly this wolf-tooth delusion must now take its allotted place in the history of the past, and this quackish dental art can no longer be considered that ophthalmic panacea, which centuries of horsemen have firmly believed in, and is endorsed by many of them to-day.

Fallacies About Disease.

Without a knowledge of the fundamental principles of pathology and its kindred branches of science, disease cannot be investigated nor its real nature understood. In every morbid action there is an abnormal condition of the system or of certain parts. Any inquiries therefore pertaining to the character of a given malady, necessitate a previous knowledge of the structure and function of the parts involved, without which every conclusion must be questionable. Hence the many existing fallacies about the nature and causation of disease that have no foundation in fact, but have crept into popular favor and practice through lack of professional ability on the part of those who pretend to be qualified veterinarians. In passing, therefore, we shall notice some of the more familiar examples to which these remarks will apply.

Anchylosis of Joints,

An osseous deposit around the pastern joint is known as ringbone. It greatly interferes with the motion of the joint, and often causes a severe form of lameness. The disease may arise in various ways, but it is usually the result of an inflammation of the extremities of the bones, and of their articulating surfaces, either from direct injuries or a strain.

Synovitis and periostitis are therefore the inevitable result of an injured joint. Bony matter is deposited upon the inflamed surface, and thus a complete osseous union or an anchylosis of the joint at last occurs. This new formation gives rise to the enlargement, a ring of bone, which by all efforts to cure can never be removed. Consequently a cured ringbone is where the upper and lower pasterns have grown together, and where there is no motion of the joint, and if the bunch is not large, all lameness will cease. Hence the only rational method of cure consists in hastening this bony union, and this can best be done by the free use of the blister and the firing-iron.

But there are many vague notions about this disease that have long been received by the uneducated farrier, as an explanation of the difficulty. "Leakage of the joint" is now the more commonly accepted opinion among horsemen. While certain quacks in want of a nice little surgical job, claim that "ringbone is caused by a *bladder*, situated behind the joint that feeds it," and therefore its immediate extraction is the only curative means to be employed. Such fallacies need only to be pointed out to be discarded, and with the true anatomical explanation given, these empirical methods must cease.

Another form of morbid bony growth, frequently met with both on the forward legs and behind, and one that often causes severe lameness for a short time, is the union of the splint with the cannon bone. This trouble usually arises from an injury, which sets up a periosteal inflammation about the parts, when an osseous callous results, thus cementing the two bones together. This having been accomplished, either by nature alone or by the aid of the surgeon's art, the animal ceases to limp, and the case is permanently cured. The bunch will gradually recede in size, and sometimes entirely disappear, so that it can be neither seen nor felt, but the two bones are firmly united and can never be separated. The claim, therefore, that "a splint can be taken off" and thus leave the leg natural again is a fallacy, as a moment's inspection of the bone afterwards would show, yet the horse in reality is none the less valuable.

But this is not the case with spavin, which consists in the growing of two or more of the tarsal bones together. The hock, before described, is a very delicately constructed joint, made up of six bones, and bound together by various ligaments. Situated at the posterior angle of the hind leg, which does most of the work in drawing, it is therefore frequently subject to severe strains, causing immediate lameness.

A general inflammation follows, succeeded by synovitis, periostitis, and anchylosis of one or more of those small joints. The cure, therefore, for spavin, like the other allied forms of disease, consists in hastening the bony union of the parts involved, by the use of the hot iron, blisters, and liniments. It may at first be confined to the scaphoid and large cuneiform, and thus end with their ossiffic union, but other bones may become involved, and ultimately it may extend to the whole joint, often causing an immense enlargement of the hock.

"CHEST-FOUNDER."

This term is a misnomer as applied to the seat of disease in the forward leg. The trouble is invariably in the feet, and the symptoms by which it can be thus recognized are unmistakable. The horse "points" the foot, or stands with the heel of the shoe raised from the ground, always steps short, and in Scotland this gait is known as "groggy-lameness."

After some time standing, the heel becomes contracted, grows down long, from want of wear, so that the hoof looks like a collar-box, being nearly as high behind as in front, and smaller than the other foot. There is heat and also tenderness on pressure in the hollow of the heel.

The sunken condition of the chest is a fallacious symptom, inasmuch as the two anterior thoracic muscles have shrunken in size, or atrophied merely from want of use in throwing the leg forward naturally, instead of taking those short steps, as compelled to, on account of the morbid condition of the navicular joint.

The degree of lameness varies greatly with the condition of the foot. When the foot is dry, and upon a dry hard road, the horse is sure to limp, and always starts off lame; but in soft muddy going, or upon a sandy road, after soaking the foot, the same animal might not for miles take a lame step. Hence the necessity of special attention to the feet in cases of this kind.

Any treatment therefore directed to the supposed trouble in the chest, by way of seatons blisters, or even liniment, only evinces the mistaken notion of the practitioner, and thus clearly sets forth another popular fallacy, which has long held sway among horsemen as a substitute for knowledge.

ACUTE LAMINITIS.

Another trouble in the foot, that is often compounded with the last, is real founder, or an acute inflammation of the lamina which lines the hoof, and thus surrounds the coffin bone. This dreadful disease is of frequent occurrence, and is caused by over-exertion, high feeding, cold water, and exposure.

The pain and suffering is very agonizing and persistent for several days, unless relieved, and the congested condition of the blood vessels, between the bone and the unyielding horny box, foreshadows to every intelligent practitioner the real surgical treatment, which the patient at once requires. Hence no time should be lost in attempting to obtain relief. The early abstraction of blood, therefore is the great desideratum. Unload the vessels and the exudation will not occur, and thus eventually destroy the foot.

SWINE PLAGUE.

This is a specific infectious disease, peculiar to swine, and is not communicable to man or other animals. It rarely occurs but once in an individual, as one attack serves to protect the system against a second invasion. The disease is especially contagious by the breath, and all hogs thus exposed are liable to become infected. Hence the necessity of strict quarantine regulations in the management of every outbreak, and all sick ones should at once be secluded from the herd.

The symptoms by which this malady in its different phases can be recognized are of a threefold character, and which may well be designated as the febrile, the choleric, and hemorrhagic. At first the hog shows some indisposition, has a slight rise of temperature, and occasionally coughs. In fact the majority suffering from this form of the disease would scarcely be recognized as being sick, upon casual examination.

But in the second stage when the "cholera" symptoms appear, there can no longer be any doubt. The disease now assumes a grave form, and is usually attended with a high rate of mortality. The animal becomes inactive, refuses to eat, but is very thirsty. The high temperature, labored respiration, and severe cough, indicate in a marked degree an internal inflammation. Pneumo-enteritis therefore well expresses the real pathological condition.

The bowels are at first constipated, but soon followed with a fetid diarrhœa, which hastens fatality. The discharges are slimy, and often stained with blood, which symptoms are very characteristic of the nature of the malady. A reddened skin is a very common symptom, and this, together with the enlarged lymphatics of the groin, become an important aid in diagnosis.

In the hemorrhagic forms the disease occurs without premonition, is very violent in character, and invariably fatal. A state of collapse is, in fact, the first symptom. The extremities become cold and numb, and the circulation is very inactive. Hence the stagnation of blood, with a dark purple hue of the skin, and large ecchymosed spots, is the inevitable sequence.

This swine plague can be communicated by the inoculation of the bronchial mucus, and the fluid from the peritoneal cavity. The blood is also virulent; thus showing that the disease belongs to the same infectious group with pleuro-pneumonia, small-pox and tuberculosis, and accordingly spreads by contagion only. Medicinal treatment, therefore, can have but little effect in cutting short the course of this malady. Conduct the mild cases to a favorable termination is all that can be reasonably expected.

GLANDERS AND FARCY.

Of all the diseases of the horse the above are by far the most loathsome and foreboding. It ranks among the few great scourges of the land, and it is decidedly the most contagious malady of the equine race. By inoculation it is transmissible to man and other animals, but not to bovines.

It belongs to the group of infectious diseases, and has its own specific virus, which can be cultivated to any extent. Glanders, therefore, extends itself by contagion only. Nor is it ever the sequel of any other malady, unless the germs had previously been implanted there.

Though differing phenomenally, in many respects, the virus of glanders and of farcy are pathologically identical. One can be reproduced from the other by inoculation, and this is the sure criterion for deciding a doubtful case of either.

The symptoms, therefore, by which glanders may be diagnosed at the earliest moment possible are of great importance to the veterinarian for the protection of life and property. The disease is often obscure, and the pathognomonic signs for a long time remain latent.

The discharge from the nose is not *alone* characteristic. It even varies greatly at different stages of the real malady. The enlarged gland on the same side, especially if it is not hard, inflamed and tender, renders it *more* suspicious; but when a *chancre* appears in the nostril, the case is *beyond a doubt.* Without the corroboration, therefore, of these three cardinal symptoms, or a successful inoculation in a healthy subject, no one would be justified in sacrificing a valuable animal, unless they knew the hors had been exposed.

The treatment which a well-marked case of glanders or farcy should receive is not medicinal. As soon as the real nature of the disease is known, the animal should at once be sacrificed. All effort to cure an undoubted case is futile. The progress of the disease may be checked for a while, by rest, good care, and supportive treatment, but as soon as the horse goes to work again, and thus begins to lose condition, the case becomes aggravated and death is sure to follow.

In certain chronic forms, however, an animal has been known to live for several years, and thus be the means of disseminating the contagion. Consequently all suspicious cases should be held in quarantine until the real nature of the malady in question can be determined by inoculation; and this should be resorted to at once, if the crucial test upon the nasal membrane is not in sight.

Epizootic Pleuro-pneumonia.

This is another specific malady, and the one of most contagious of bovine animals. It never attacks the horse and hog, nor can it be conveyed to the human subject. The disease spreads by virtue of its own infection, and never arrives spontaneously. No filthy abode, nor any combination of unsanitary conditions can produce it, without the presence of these stealthy germs to contaminate the place. This dreaded scourge, therefore, is not easily extirpated nor controlled wherever it occurs.

Like other diseases of this class, it runs a natural course and cannot be cut short. Hence, to conduct to a favorable termination is all that can be done by way of treatment. Strict quarantine regulations should be resorted to at once, and thus the cordon tightly drawn, when the disease first breaks out. The want of such sanitary measures has cost this country already a sad financial experience, and still the disease is uncontrolled for want of means to stamp it out.

Tuberculosis.

Though other plagues operate in a more summary manner, yet the ravages from this disease are none the less to be dreaded. The sure but stealthy march, of late years, which this insidious malady has made upon some of the finest herds of our land has awakened a deep interest among breeders concerning its real specific nature and hereditary transmission.

This old-fashioned and long-known scrofulous consumption of cattle has now been placed, by the rapid advancement in veterinary pathology, among the contagious diseases. The great liability, therefore, of its direct transmission to human beings through the agency of infected milk is one of the most important questions to-day before the public. Consequently, the wide-spread prevalence of this fatal malady among the cows of this country will soon call for new sanitary regulations.

Calculous Disorders.

The extent to which urinary gravel occurs in domestic animals and the symptoms by which the trouble can be recognized, has not received that attention in this country which the subject now demands. In a former paper I have alluded to the presence of urethral calculi in the ox,* and the fatal consequences that are sure to follow if not attended to at once.

In the horse these concretions often become very large and thus cause great difficulty in urinating, as shown by frequent straining, and the passage of blood for weeks and months. The two successful operations of lithotomy, however, which I have recently performed, and the removal of a large stone from the bladder of both a horse and a mare, affords us hope that this serious difficulty, which no doubt is of more frequent occurrence than we have hitherto been aware, can be readily overcome and the patient cured.

CONCLUSION.

Thus I have glanced at some of the facts in comparative anatomy and pathology which every farmer should know in relation the diseases of animals. I have alluded to certain popular fallacies which, like "horn-ail" of old, will vanish from the mind as soon as the light of veterinary knowledge shall dawn upon the believer.

There are fallacies in therapeutics also which have long held sway, and one especially that deserves a passing notice. The favorite method among horsemen of treating pneumonia by the use of mustard pastes instead of hot applications to the chest, is fallacious in theory and unsuccessful in practice, as every physician and well-informed veterinarian knows. Hence, we are admonished on every hand to aid in the diffusion of practical scientific knowledge, that the diseases of live stock may be better understood, our health thus protected, and the afflicted animals more humanely treated.

The following resolutions were then read and unanimously adopted:

Whereas, Pleuro-pneumonia, a very contagious and fatal disease among cattle, has a recognized existence in our country, threatening the most direful results on the prosperity of our farmers and dealers in and exporters of live stock, therefore be it resolved—

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* See Natural History of Bezoar stones, calculi, and other animal concretions, in Secretary's Report for 1878.

First, That the Connecticut Board of Agriculture, upon well considered action, do declare that the threatened evil, in their opinion, has become of national concern.

Second, That they recommend to their representatives in Congress to take into consideration the injuries which this disease, if unchecked or uncontrolled, is capable of, and to carefully devise immediate measures to regulate the movements of stock, and to take such other means as shall be necessary to eradicate the disease from the country.

Third, That, in the opinion of this convention, this emergency should be met with immediate action, and the measures to be devised should be thorough and radical.

RETURNS OF AGRICULTURAL SOCIETIES, 1880.—FINANCES.

SOCIETIES.	Amount received from State.	Membership and Fees.	Donations.	All other sources.	Receipts for the year.	Premiums offered.	Premiums and Gratuities awarded.	Premiums and Gratuities paid.	Current expenses of the year, not including Premiums.	Disbursements for the year.	Indebtedness.	Value of real estate.	Value of personal property.
Connecticut State	$2,000.00	$5,275.96	....	....	$7,275.96	$3,800.00	....	$2,786.00	$2,801.00	$5.087.00	....	....	$2,685.61
Hartford County	200.00	143.00	....	$301.28	644.28	291.00	....	....	654.08	....	....	....	....
New Haven County	200.00	595.00	....	1,509.78	2,304.78	2,800.00	....	838.00	1,466.78	2,304.75	....	$........	....
New London County	300.00	4,274.17	$160.50	516.70	5,201.87	2,405.85	....	2,294.85	2,642 40	5,047.95	$6,042.40	10,000.00	450.00
Fairfield County	200.00	64.00	....	5,646.47	5,910.47	1,382.75	$765.75	765.75	2,008.61	4,489.86	9,500.00	21,401.04	800.00
Windham County	200.00	2,851.75	....	....	2,843.75	1,624.45	....	....	1,087.67	....	....	8,500.00	256.63
Tolland County	200.00	458.75	81.75	159.84	900.34	540.00	585.25	495.25	500.00	1,085.28	1,000.00	2,500.00	100.00
Bloomfield	100.00	100.00	....	....	200.00	....	169.75	150.00	88.48	192.48	....	....	11.00
Clinton	100.00	294 80	....	84.00	478.80	....	....	250.80	177.18	827.98	....	....	206.88
Danbury	100.00	7,000.45	....	1,088.97	8,189.88	8,028.50	2,581.60	2,587.85	8,178.97*	6,169 17	....	10,000.00	2,000.00
East Granby	100.00	50.00	40.00	10.00	200.00	196.75	151.90	157.90	40.00	191.90	....	....	15.00
Guilford	100.00	180.85	40.00	80.00	400.85	205.00	....	205.00	163 65	368.65	....	....	400.00
Harwinton	100.00	11.50	....	231.00	346.50	75.75	....	18.25	228.49	241.74	....	....	298.40
New Milford	....	....	....	....	....	....	....	....	....	....	....	....	....
Milford and Orange	100.00	580.00	....	865.70	1,545.70	1,225.00	967.75	905.00	514.05	1,419 05	250.00	....	1,200.00
Oxford †	100.00	75.00	25.75	....	200.75	118.65	....	....	....	....	....	....	....
Pequabuck	100.00	818.25	....	150.00	1,068.25	500.00	....	838.25	288.98	622.28	....	....	....
Ridgefield	100.00	689.76	....	179.85	969.71	650.00	510 15	505.15	456.88	961.98	475.00	5,000.00	200.00
Simsbury	100.00	200.00	....	20.00	320.00	184.00	214.00	204.00	112 85	816 85	....	....	....
Suffield	100.00	125.00	51.50	493.50	770.00	449.50	....	361.20	368.41	524.61	....	....	....
Tolland County, East	100.00	1,486.29	15.10	30.00	1,631.39	894.00	767.05	741.40	276 43	8,299.68	2,386.57	2,500.00	500.00
Union (Falls Village)	100.00	....	....	....	1,081.70	985.00	....	1,085.59	....	....	818.89	....	800.00
Union (Somers, etc.)	100.00	5.00	....	18.00	123.00	160.00	....	....	82.87	....	....	....	....
Union (Monroe, etc.)	100.00	1,127.87	39.00	309 00	1,575.87	842.50	....	642.75	462.74	1,576.95	600.00	3,000.00	....
Waterbury	100.00	384.00	....	....	484.00	885.00	228.00	212.00	156 00	368 00	....	....	25.00
Watertown	100.00	800.00	....	1,841.00	2,741.00	1,800.00	....	1,650.00	875.00	2,525.00	....	....	50.00
Woodbridge and Bethany	100.00	583.50	....	82.60	666 10	....	....	....	....	....	....	....	....
Woodbury	100.00	221.00	....	....	786.74	701.90	601.80	518.74	848.82	762.06	....	....	....
Woodstock	100.00	1,101.11	....	268.38	1,169.49	1,253.50	....	1,026.80	500.00	1,526.80	500.00	5,725.00	85.00

* Permanent improvements.

† Rainy day.

NUMBER OF ANIMALS EXHIBITED.

SOCIETIES.	Bulls.	Milch Cows.	Heifers.	Calves.	Working Oxen, (pairs).	Steers, (pairs).	Fat Cattle.	Horses.	Sheep.	Swine.	Poultry, (coops).	Other Stock.
Connecticut State	80	67	115	..	21	..	8	66	279	2	102	..
Hartford County *	..	..	..	..	..	..	..	..	..	..	..	..
New Haven County	12	80	34	18	40	10	12	94	188	4	125	..
New London County	25	71	88	60	48	80	10	86	111	18	24	..
Fairfield County	10	10	6	4	51	8	4	43	15	2	94	..
Windham County	88	87	48	46	76	75	5	94	189	10	120	..
Tolland County	5	11	6	7	9	12	8	23	7	8	26	58
Bloomfield	5	12	..	7	15	7	8	16	..	..	8	..
Clinton	14	28	6	16	32	10	8	18	50	55	85	..
Danbury	6	12	6	11	87	25	8	119	14	5	182	49
East Granby	7	50	10	8	20	10	..	10	15	5	6	20
Guilford	6	10	5	15	98	8	9	81	27	21	18	..
Harwinton	..	..	..	..	..	..	..	..	..	..	..	..
New Milford	..	..	..	..	..	..	..	..	..	..	..	..
Milford and Orange	5	12	6	6	9	10	2	65	15	12	17	..
Oxford	8	2	8	5	5	1	2	5	..	..	1	..
Pequabuck	18	24	82	11	11	15	2	18	21	5	87	..
Ridgefield	2	6	4	..	11	8	..	41	..	9	17	..
Simsbury	..	..	..	..	..	..	..	..	..	..	..	..
Suffield	..	..	..	..	..	..	..	..	..	..	..	..
Tolland County, East	..	..	..	..	..	..	..	..	..	..	..	..
Union (Falls Village)	..	..	..	..	..	..	..	..	..	..	..	..
Union (Somers, etc.)	8	7	..	4	87	20	2	18	18	5	2	..
Union (Monroe, etc.)	..	..	..	..	..	..	..	..	..	..	..	..
Waterbury *	..	..	..	..	..	..	..	..	..	..	..	..
Watertown	22	52	35	36	42	26	4	..	54	20	..	..
Woodbridge and Bethany	7	..	..	31	21	10	8	5	20	2	20	..
Woodbury	..	..	..	..	..	..	..	..	..	..	..	..
Woodstock	18	66	49	24	38	86	8	18	73	20	84	..

* No exhibition of Stock.

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED.

FARM STOCK.

SOCIETIES.	Bulls.	Milch Cows.	Heifers.	Calves.	Working Oxen.	Steers.	Fat Cattle.	Horses.	Sheep.	Swine.	Poultry.	All other Stock.	Total amount awarded for Live Stock.	Total amount paid for Live Stock.
Connecticut State	$232.00	$228.00	$147.00	....	$66.00	$59 00	$13.00	$204.00	$300.00	$8.00	$51.00	$1,157.00	$2,465.00	$2,465.00
Hartford County	....	....	....	....	....	...	....	....	....	....	....	.....	.....	.....
New Haven County	40.00	87.00	68.00	$23.00	94.00	25.00	62.00	1,016.00	78.00	10.00	63.00	.....	1,541 00	685.00
New London County	254.50	377.50	74.00	32.00	85.00	37.50	16.50	1,892.00	184.25	92.00	13.65	.....	.....	. ...
Fairfield County	13.00	12.00	6.00	10.00	100 00	10.00	16.00	90.00	22.00	1.00	45.50	.....	286.00	286.00
Windham County	88.00	77.00	61.00	89.89	164.00	46.00	10.00	535.00	40.00	26.00	123.00	.....	.....	1,259.00
Tolland County	14.00	12.00	7.00	4.00	23.00	13.00	4.00	33.00	5.00	8.00	18.00	33.80	174.00	.....
Bloomfield	9.00	17.00	....	8.50	46.00	12.00	10.00	84.00	....	2.00	4.00	.....	141.50	133.50
Clinton	8.00	16.00	5 50	6.50	21.50	4.00	2.50	15.00	8.50	15.50	28.40	5.50*	136.90	133.90
Danbury	....	44.00	11.00	4.50	82.00	40.00	19.00	1,820.00	28.00	42.00	115 00	72.50	1,721.50	.....
East Granby	11.00	32.00	7.00	4.00	24.00	6.00	...	18.00	5.00	1.50	.75	5.40	114.65	114 65
Guilford	5.00	5.50	2.00	2.25	24.00	4.50	3.00	22.00	5.00	6.00	5.00	.....	.....	84.25
Harwinton	....	.. .	....	....	....	. ..	....	....	....	....	....	.....	.....	9.00
New Milford	....	....	....	....	....	....	....	....	....	....	....	.....	.....	.....
Milford and Orange	8.00	13.00	4.00	3.50	53.00	10.50	2.00	775.00	2.50	11.00	6.50	.....	889.00	852.00
Oxford	1.50	1.50	1.00	.50	7.00	1.50	2.00	9.50	....	....	.50	18.00	43.00	.....
Pequabuck	13.00	29.00	11.00	13.00	11.00	14.00	5.00	19.00	10 00	7.00	59.00	.....	.....	.....
Ridgefield	5.00	8.00	5.00	....	30.00	5.00	....	306.50	....	3.00	8.15	.....	371.00	367.00
Simsbury	10.50	8.50	5.00	1.50	49.00	11.00	....	76.00	1.50	2 50	8.50	.....	174.00	174.00
Suffield	10.00	31.00	6.00	3.00	13.50	4.50	....	24.00	6.00	6.00	....	280 00	849.00	321.50
Tolland County, East	3.00	7.00	1.00	5.50	19.00	9.00	3.00	9.00	5.00	2.75	3.00	.....	134.00	.....
Union (Falls Village)	....	....	....	....	....	....	....	...	....	....	....	.....	.....	.....
Union (Somers, etc.)	5.00	4.00	....	3.00	32.25	19.75	2.50	16.50	3.00	....	...	.....	.....	.....
Union (Monroe, etc.)	18.50	9.00	6.00	2.50	24.00	22.00	8.00	71.00†	18.00	3.00	22.25	61.00	255.25	239.25
Waterbury	....	....	....	....	....	....	....	....	....	....	....	.....	.....	.....
Watertown	29.00	57.00	28.00	15.00	119.00	31.00	7.00	91.00	....	16.00	....	.....	886.50	.....
Woodbridge and Bethany	12.00	....	....	16.75	69.00	5.00	9.00	79.25	7.00	2.00	22.50	.....	222.50	.....
Woodbury	....	....	....	....	....	....	....	....	....	....	....	.....	.....	.....
Woodstock	34.00	65.00	58.00	24.00	95.00	50.00	6.00	259.00	16.00	26.00	55.00	.....	736.00	.....

* String Teams, etc.

† Does not include horse trots.

ANALYSIS OF PREMIUMS AND GRATUITIES.—CONTINUED.

FARM PRODUCTS.

SOCIETIES.	Indian Corn.	Wheat.	Rye.	Barley.	Oats.	Beans.	Grass seed.	Potatoes.	Carrots.	Beets.	Parsnips.	Turnips.	Onions.	Other root crops.
Connecticut State	$12.00	$8 00	$8.00	$8.00	$8.00	$6.00	$6.00	$11.00	$2 00	$7.00	$1.00	$4.00	$6.00	$18.00
Hartford County	3.50	1.00	1.00	1.00	1.00	1.00	....	3.00	1.00	1.00	1.00	1.00	1.00	7.00
New Haven County	14.00	2.00	11.50	1.50	1.00	7.00	....	16.00	5.50	5.50	1.50	11.00	7.00	....
New London County	1.75	2.50	1.25	....	1.25	8.75	2.50	4 75	1.25	2.50	1.25	1.00	2.50	....
Fairfield County	5.50	2.50	2.50	2.50	....	....	....	12.50	1.50	1.50	1.50	1.50	4.50	....
Windham County	....	....	....	....	8.75	....	....	17.75	....	....	....	....	18.50	....
Tolland County	8.00	.25	8.00	....	.25	1.00	...	11.00	.75	1.00	....	3.25	1.00	14.75
Bloomfield	1.25	.25	.25	....	.25	.25	....	1.25	....	.50	....	....	.25	1.25
Clinton	8.00	....	.60	....	.60	6.20	....	6.60	.60	8.40	.60	1.40	2.60	....
Danbury	2.50	2.50	2.50	....	2.50	1.00	....	19.75	1.50	4 50	....	4.00	8.25	18.85
East Granby	1.00	.50	.50	....	....	....	.....	1.50	....	.25	....	....	.25	....
Guilford	11.00	2.25	.75	....	.50	.75	....	16.00	1.25	8.50	.50	2.25	8.75	17.75
Harwinton	....	....	....	....	....	....	....	....	....	....	....	....	....	....
New Milford	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Milford and Orange	1.25	1.00	1.00	.50	.50	1.00	....	6.00	....	.75	.25	.25	1.25	1.00
Oxford	....	....	....	....	....	....	....	....	....	....	....	....	....	...
Pequabuck	1.50	2.25	.50	....	....	....	....	6.25	.75	.75	.75	.75	....	....
Ridgefield	8.25	2.25	1.50	....	.75	....	....	1.25	.25	.75	......	.25	8.50	6.65
Simsbury	3.00	....	1.50	....	....	....	....	2.00	....	1.00	....	1.00	1.00	...
Suffield	5.00	....	....	....	...	....	....	1.75	.75	1.50	....	2.00	.50	....
Tolland County, East	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Union (Falls Village)	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Union (Somers, etc.)	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Union (Monroe, etc.)	7.00	2.50	8.00	....	1.00	....	....	14.00	1.50	7.00	1.50	6.50	9.25	19.00
Waterbury	2.50	....	....	....	....	....	....	8.00	....	2.00	....	1.00	1.00	11.00
Watertown	1.50	.75	.75	....	.75	.75	1.50	5.00	1.50	1.50	....	1.50	1.50	....
Woodbridge and Bethany	7.25	....	1.25	.75	.75	2.75	....	11.00	.75	8.25	.50	1.50	8.00	....
Woodbury	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Woodstock	11.00	2.25	1.50	1.50	1 50	2.00	....	6.75	1.00	4.00	.75	4.00	87.00	....

ANALYSIS OF PREUMIMS, AND GRATUITIES—CONTINUED.

FARM PRODUCTS.

SOCIETIES.	Total amount offered for Grain and Root Crops.	Total amount awarded for Grain and Root Crops.	Total amount paid for Grain and Root Crops.	Plowing at Exhibition.	Fruits.	Flowers.	Butter.	Cheese.	Honey, Maple Sugar, and Preserved Fruits.	Bread and Cake.	Total amount paid for Farm Products.	Amount awarded for Farm Implements.	Mechanical Inventions, Domestic Manufactures, etc.	Number of Diplomas.	Number of Medals.
Connecticut State	$93.00	$80.00	...	....	$98.00	$22 00	$18.00	$18.00	$18.00	$6.00	$250.00	....	$67.00	115	....
Hartford County	35.50	....	....	....	59.50	76.18	8.00	5.00	10.50	10.00	....	....	....	54	2
New Haven County	104.00	73.50	$18.00	$8.00*	118.00	18.00	3.00	2.00	4.00	16.00	66.00	$45.00	95.00	20	....
New London County	....	14.50	....	17.00	87.00	14.50	18.25	8.25	....	8.75	....	16.00	94.80	2	....
Fairfield County	157.50	71.00	71.00	....	75.00	58.50	3.00	....	12.00	15.00	270.00	31.50	55.50	19	11
Windham County	....	....	....	....	55.85	59.75	14.00	14.00	8.00	8.00	204.60	25.25	60.50†	8	....
Tolland County	25.00	64.65	....	....	51.50	2.50	7.50	2.00	4.00	5.50	....	....	15.25	....	....
Bloomfield	....	5.50	4.75	....	9.00	.50	1.00	1.00	.50	.50	16.25	1.00	8.25	....	....
Clinton	....	30.60	....	....	18.20	8.60	.30	....	10.70	2.80	80.10	10.70	7.80†	....	....
Danbury	78.25	49.00	....	....	98.50	72.00	8.50	2.00	15.50	27.00	....	25.00	4.00	33	...
East Granby	6.25	5.00	5.00	....	4.50	1.00	1.00	.50	.75	.50	18.25	...	18.00	....	....
Guilford	60.25	....	60.25	....	89.25	8.50	.75	.50	8.75	3.00	111.00	....	9.75	....	....
Harwinton	....	....	....	....	....	....	....	....	....	....	....	...	....	...	...
New Milford	....	....	....	...	....	....	....	....	....	...	....	....	....	....	....
Milford and Orange	19 00	14.75	14.75	....	25.75	1.75	1.50	....	7.25	1.50	58.00	....	....	8	....
Oxford	8.70	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Pequabuck	....	....	....	....	18.25	1.50	....	2.00	.50	3.65	....	....	....	....	....
Ridgefield	72.75	20.40	20.40	....	14.50	14.50	.75	.25	9.25	10.00	69.65	12.25	57.25	...	8
Simsbury	....	....	....	....	8.00	1.50	....	....	2.00	1.00	19.00	3.50	....	....	....
Suffield	17.00	17.00	9.00	....	15.00	....	8.00	....	2.00	....	26.85	5.00	....	....	....
Tolland County, East	30.00	....	....	....	....	2.25	1.50	1.50	2.50	1.50	87.00	....	....	7	....
Union (Falls Village)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Union (Somers, etc.)	8.00	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Union (Monroe, etc.)	89.75	75.50	68.75	....	96.50	12.50	6.00	8.00	6.50	18.00	200.75	1.00	46.75	....	....
Waterbury	65.00	25.50	23.00	....	14.50	27.00	2.00	1.00	2.00	6.00	58.00	....	170.00	....	....
Watertown	14.50	6.00	6.00	....	88.00	20.00	8.00	8.00	11.25	5.25	94.75	30.00	88.00	....	....
Woodbridge and Bethany	....	....	25.65	....	49.75	12.50	2.50	4.00	7.00	5.00	106.40	....	49.85	....	....
Woodbury	....	...	....	....	....	....	....	....	....	....	....	....	....	....	...
Woodstock	67.50	....	....	....	45.70	48.50	5.00	6.00	11.50	1.00	....	25.00	120.00	5	5

* Spading.

† Fine Arts and Fancy Articles, $75.10—Clinton $17.90.

OFFICIAL LIST OF FARMERS' CLUBS IN CONNECTICUT—1880-81.

NAME OF CLUB.	PRESIDENT.	SECRETARY.
New Haven County	James J. Webb.	Cullen B. Foot.
Bristol	S. R. Gridley.	John Winslow.
Cheshire	Charles S. Gillette.	N. S. Platt.
Chester	A. H. Gilbert.	C. E. Lord.
Clinton	John P. Johnson.	Joseph H. Sperry.
Columbia	Joseph Hutchins.	W. H. Yeomans.
East Windsor	Daniel W. Bartlett.	John F. Fitts.
Guilford	Sidney W. Leete.	R. H. Woodruff.
Hamden	G. W. Bradley.	C. P. Augur.
Killingworth	L. L. Nettleton.	Francis Turner.
Lebanon	O. E. Pettis.	Wm. Huntington.
Meriden	Oliver Rice.	Levi E. Coe.
Middlefield	J. T. Inglis.	P. M. Augur.
Morris	A. C. Tracy.	S. W. S. Skilton.
Mystic	Jeduthun Whipple.	L. W. Crouch.
Naugatuck	J. B. Tolles.	M. S. Baldwin.
Newington	Heman A. Whittlesey.	John S. Kirkham.
North Stonington	T. W. Wheeler.	F. S. Peabody.
New Britain	L. S. Wells.	A. C. Blake.
Pomfret	John Dimon, Putnam.	B. S. Warner.
Tunxis	Alpheus Porter.	T. G. Wilcox.
Westbrook	Richard H. Stannard.	G. A. Post.
West Cornwall	Dwight Rogers.	T. S. Gold.
Westport	Wm. J. Jennings.	S. B. Sherwood.
Willimantic	J. H. Stearns.	N. P. Perkins.
Wilton	D. N. Van Hoosear.	D. H. Van Hoosear.
Woodstock	F. M. Fox.	Dr. G. A. Bowen.

OFFICIAL LIST OF AGRICULTURAL SOCIETIES IN CONNECTICUT, 1880–81.

NAME OF SOCIETY.	PRESIDENT.	SECRETARY.	TREASURER.
Connecticut State,	James A. Bill, Lyme.	L. E. Coe, Meriden.	Wm. H. Gross.
Hartford County,	J. C. Capen, Bloomfield.	Warren Rowley, Hartford.	Wm. H. Gross.
New Haven County,	D. N. Clark, Woodbridge.	C. P. Augur, Whitneyville.	Frank S. Platt.
New London County,	H. W. Kingsley.	Joab B. Rogers, Norwich.	F. L. Gardner.
Fairfield County,	J. E. Wheeler, Saugatuck.	Wm. D. Gregory, Norwalk.	Wm. A. Curtiss.
Windham County,	Alexander Warner, Pomfret.	Willard Day, Danielsonville.	A. Wylie.
Litchfield County,*	Harry Sedgwick, Cornwall Hollow.	D. C. Kilbourn, Litchfield.	E. C. Jones.
Middlesex County,*	J. M. Hubbard, Middletown.	G. W. Wilson, Middletown.	G. W. Wilson.
Tolland County,	E. H. Owen, North Manchester.	J. C. Hammond, Jr., Rockville.	E. S. Henry.
Bloomfield,	H. G. Fish, Bloomfield.	J. E. Cox, Bloomfield.	H. W. Rowley.
Clinton,	J. P. Johnson, Clinton.	Sturger G. Redfield.	E. E. Post.
Danbury,	John W. Bacon, Danbury.	B. C. Lynes, Danbury.	J. W. Bacon.
East Granby,	C. H. Hanchett, East Granby.	H. L. Clark, East Granby.	J. W. Thompson.
Guilford,	Arthur S. Fowler, Guilford.	J. S. Benton, Guilford.	G. B. Spencer.
Harwinton,	James Mather, Harwinton.	A. Webster, Harwinton.	A. Webster.
New Milford,	W. D. Black, New Milford.	Robert Erwin, New Milford.	Charles Randall.
Meriden, †	L. P. Chamberlain, Meriden.	L. E. Coe, Meriden.	L. H. W. Yale.
Milford and Orange,	A. N. Clark, Milford.	E. G. Miles, Milford.	C. F. Smith.
Oxford,	J. H. Bartlett, Oxford.	E. B. Treat, Oxford.	C. H. Butler.
Pequabuck,	M. H. Barnard, Bristol.	G. H. Gowdy, Bristol.	G. H. Gowdy.
Ridgefield,	E. H. Smith, Ridgefield.	E. L. Smith, Ridgefield.	D. S. Sholes.
Simsbury,	N. W. Holcomb, Simsbury.	Phelps Tuller, Simsbury.	J. W. Holcomb.
Suffield,	M. J. Sheldon, Suffield.	W. F. Fuller, Suffield.	W. F. Fuller.
Tolland County East,	W. Holman, Tolland,	E. T. Converse, Stafford Springs.	R. S. Hicks.
Torrington,*	E. H. Smith, Torrington.	C. James, Torrington.	C. James.
Union (Falls Village),	Charles Barnum, Lime Rock.	C. B. Maltbie, Falls Village.	O. M. Brinton.
Union (Somers, etc.),	Amos Pease, Somers.	John T. McKnight, Ellington.	C. M. Abbe.
Union (Monroe, etc.),	E. M. Beardsley, Monroe.	Joseph Tomlinson, Birmingham.	S. H. Blackman.
Waterbury,	Samuel Root, Waterbury.	C. N. Hall, Waterbury.	G. S. Parsons.
Watertown,	G. A. Woodruff, Watertown.	A. Warner, Watertown.	F. B. Hand.
Woodbridge and Bethany,	E. W. Judge.	S. G. Davidson, Bethany.	S. G. Davidson.
Woodbury,	B. S. Russell, Woodbury.	W. E. Scovill, Woodbury.	A. A. Root.
Woodstock,	G. A. Bowen, Woodstock.	H. T. Child, Woodstock.	E. T. Warner.

* No Fair.

† Fair relinquished for State Society.

REPORT OF THE TREASURER.

Nathan Hart *in account with*

The State Board of Agriculture.

Jan. 1, 1880,	Balance in Treasury,		$990.72
Jan. 12, 1881,	Received from State Treasury,		2,500.00
			$3,490.72

PAID.

March 1, 1880,	P. M. Augur,		$100.00
" 2, "	J. M. W. Yerrington,		128.90
June 7, "	W. O. Atwater,		25.00
Aug. 4, "	The Case, Lockwood & Brainard Co.,		110.65
Dec. 17, "	Wm. Holman,		23.00
" " "	C. T. Hickox,		21.60
" " "	R. W. Robinson,		55.15
" " "	J. J. Webb,		19.00
" " "	Albert Day,		50.45
" 21, "	P. M. Augur,		17.58
Jan. 12, 1881,	T. S. Gold, Salary,	$700.00	
	Traveling expenses,	177.76	
	Stationery,	12.48	
	Postage,	47.77	
	Express and Freight,	48.47	
	Telegrams,	3.81	
Nov. 8, 1880,	Dr. Parkinson,	35.00	
Dec. 17, 1880,	Hotel at New Britain,	52.75	
	Incidentals at New Britain,	10.37	
	Expense, Cattle Commission,	11.50	
	Printing, Wm. Rogers,	.75	
	Prof. Collier, Expenses,	3.50	
	Dr. Cressy, Lecture,	26.00	
	Prof. Johnson, Lecture,	25.78	
	J. M. Hubbard, Lecture,	25.00	
	J. B. Olcott, Lecture,	28.00	
	Prof. Beal, Lecture,	66.55	
	Sec. Northrop, Lecture,	25.00	
	Prof. Brewer, Lecture,	25.00	
	Prof. Atwater, Lecture,	25.75	
	T. R. Laughton,	20.00	
	Dr. Cressy (Veterinary),	100.27	
	Dr. Sturtevant, Lecture,	30.85	
			$1,502.36

Jan. 12, 1881,	J. T. Rockwell,	3.25
	J. M. Hubbard,	11.25
	L. S. Wells,	9.00
	H. L. Stewart,	60.30
	James A. Bill,	29.50
	E. H. Hyde, on Cattle Commission,	468.24
	Dr. James Law (Veterinary),	20.00
	Dr. Liautard, "	32.50
	Balance in Treasury,	802.99
		$3,490.72

Dec. 17, 1880,	Special appropriation for Lectures, gathering Statistics, etc.,		$500.00
Dec. 31, 1880,	Paid J. C. Dillon,	$25.00	
	Paid Rev. Wm. Clift,	50.00	
			75.00
	Balance in Treasury,		$425.00

NATHAN HART, *Treasurer*.

WEST CORNWALL, Jan. 12, 1881.

DETAILS OF EXPERIM

Kind of Crop,—*Corn*. Set of Fertilizers, "Full Size" or "Half-Size,"—*Half-Size*. Dimensions of each Plot: Length,—12 *rods*, 9½ *feet*. Width,—10½ *feet*. No. of
Seed per acre,—8 *quarts*. Date of Planting,—*May 24-25*. Date of Harvesting,—*Oct. 22-8*.

PLEASE OBSERVE THE FOLLOWING DIRECTI

Column No. 1.—As the bags are numbered 1, 2, 3, etc., the plots can have the same numbers. After these can follow the other fertilizers used—lime, stable manure, etc., etc.

Columns Nos. 4 and 5.—Designate merchantable produce as "good," that which is not merchantable as "poor," unless you have some better way of distinguishing between the qualities. In the latter case follow your own plan and explain it below. Give amounts per plot as determined by weighing, in column 4, or by measurement, in 5. It will be better, of course, to both weigh and measure. With corn, state whether measured in the ear or shelled. It will be very useful to determine weights of both ears and shelled corn, and shrinkage in curing.

Column No. 6.—It will be very interesting to learn the proportion of stalks to grain under the influence of the different fertilizers. Be particular to have stalk

Columns Nos. 7, 8
careful to make due al
the ears were weighed j
bushel or more of shelle
corn may weigh 56 lbs.,
Give below your figures

Columns Nos. 10 A

Method of distinguishing good produce from poor,—*Merchantable corn designated as "good," unmerchantable as "poor."* Pounds allowed for bushel of produce,—80
34 bushels. Other remarks,—*The stalks above the ear seemed thoroughly dried, but below, still somewhat wet at time of weighing. Plots 20 and 21, which here follow 000, in*

1	2	3	4		5		6	7		8		9
	FERTILIIZERS.		YIELD PER PLOT.					CALCULATED YIELD PER ACRE.				
No. of Plot.	Kind.	Amount *per plot.*	Give pounds, bushels, or both.				Stalks or Straw.	Please compute carefully and insert without fail either pounds, or bushels, or both				
			Grain, Roots, or Tubers. (If Corn, state whether in Ear or Shelled. *In Ear.*)					Grain, Roots, or Tubers. (If Corn, give figures for Shelled, not Ears.)				Stalks or Straw.
		Pounds.	Pounds.		Bushels.		Pounds.	Pounds.		Bushels.		Pounds.
			Good.	Poor.	Good.	Poor.		Good.	Poor.	Good.	Poor.	

0	No Manure,		[illegible]	[illegible]			[illegible]			[illegible]	[illegible]		[illegible]
1	Nitrogen Mixture,	7½	141.8	20.5			116.8			35.5	2.6		2,33
2	Superphosphate,	15	173.3	17.5			141.0			43.3	2.2		2,82
3	Muriate of Potash,	7½	117.5	15.8			123.8			29.4	2.0		2,47
4	Nitrogen Mixture, Superphosphate,	7½ 15	193.5	16 5			151.3			48.4	2.1		3,02
5	Nitrogen Mixture, Muriate of Potash,	7½ 7½	95.8	21.0			125.0			23.8	2.6		2,50
6	Superphosphate, } Mixed Mur. of Potash, } Minerals,	15 7½	178	12.3			159.8			44.5	1.5		3,19
7	Mixed Minerals (as No. 6), Nitrate of Soda,	22½ 7½	222.3	14.8			196.0			55.6	1.9		3,92
8	Mixed Minerals, Nitrate of Soda,	22½ 15	242.3	14.5			216.5			60.6	1.8		4,33
9	Mixed Minerals, Nitrate of Soda,	22½ 22½	230.3	19.3			213.5			57.6	2.4		4.27
6a	Mixed Minerals (as No. 6),	22½	187.3	14.0			160.8			46.8	1.8		3,21
00	No Manure,		141.3	18.3			127.5			35.8	2.3		2,55
10	Mixed Minerals, Nitrogen Mixture,	22½ 7½	230.0	8.8			198.8			57.5	1.0		3,97
11	Mixed Minerals, Nitrogen Mixture,	22½ 15	258.0	15.0			253.0			64.5	1.9		5,06
12	Mixed Minerals, Nitrogen Mixture,	22½ 22½	267	10.0			259.0			66.8	1.8		5,18
6b	Mixed Minerals (as No. 6),	22½	186	14.0			200.0			46.5	1.8		4,00
13	Mixed Minerals, Sulphate Ammonia,	22½ 11¼	220.5	17.5			223.0			55.1	2.2		4,46
14	Mixed Minerals, Dried Blood,	22½ 22½	210.8	13.5			188.3			52.7	1.7		3,76
15	Peruvian Guano, Muriate of Potash,	22½ 7½	197.3	17.3			180.8			49.3	2.2		3,61
16	Mixed Minerals (as No. 6),	15 7½	150.3	18.8			176.5			37.6	2.4		3,53
17	*Bone and Mur. of Potash*,(1)	42½	200.3	10.5			196.3			50.1	1.8		3,92
18	*Compost*,(2)		148.0	16 0									
19	*Lime*,	100	133 0	16.0			125.0			33.3	2.0		2,50
000	No Manure,		151.8	16.3			137.0			37.9	2.0		2,71
20	*Bone Dust*,	10	161.0	18.5			148.0			40.3	2.3		2,96
21	*Bone Dust*, *Muriate of Potash*,	10 7½	182.5	14.8			154.8			45.6	1.9		3,09

* The figures for "increase of yield" have been recalculated by the method described in explanation of "Table of Differences," and the resulting figures s
duplicates of "Mixed Minerals," 6, 6a, 6b, and 16 agree better. W. O. A. (1.) Plot 17. Bone-dust, 35 lbs. Muriate of Potash, 7½ lbs. (2.) The Compost was a carefully
quantities, it did as little good as it did here.

REPORT OF FIELD EXPERIMENTS WITH FERTILIZERS—1880.

BY PROF. W. O. ATWATER, WESLEYAN UNIVERSITY, MIDDLETOWN, CONN.

The report of the Connecticut Board of Agriculture for 1877 contained accounts of field experiments with fertilizers, suggested by the State Agricultural Experiment Station, and conducted by a number of intelligent farmers in the State.

The outgrowth of these, in the form of extended series of experiments, has been reported in succeeding volumes of the same publication. I hope to be able, in the not too distant future, to collate the data of the four seasons' experimenting, and publish them with needed details, and add such inferences as to methods and results as may seem warranted. The present article will be devoted mainly to an exposition of the principal results of the work during the fourth season, 1880.

The experiments of the four seasons have been conducted by several Agricultural Colleges, and not far from three hundred farmers, in most of the States east, and some west of the Missisippi, and in several of the provinces of British America. Their extensive circulation is due in large part to the *American Agriculturist*, which proposed them to its readers arranged, and with the hearty co-operation of several prominent dealers in fertilizers, to provide the materials, subject to analysis by the writer, and at prices just covering the cost.*

I may say that both the journal which proposed the experiments, and the parties who put up the fertilizers displayed a great deal of enthusiasm in the undertaking, doing this, as I happen to know, at pecuniary cost to themselves, and with no prospect of gain other than would come with the credit for encouraging the enterprise. Details of plan and execution of the experiments are given in the Appendix. The chief labor of arranging and tabulating the results has been performed by my friend and assistant, Mr. Miles Beamer, C. E.

GENERAL AND SPECIAL EXPERIMENTS.

These experiments have been of two classes: The first, which may be called general experiments, involved the use of seven or eight or more different kinds and mixtures of fertilizing materials containing nitrogen, phosphoric acid, and potash. These were intended to be used by farmers as a means of learning by actual trial what fertilizing ingredients would most benefit their soils and crops. The second class, or the special experiments, have been of more complicated character, and have had for their object the study of the feeding capacities of some of our more common cultivated plants, with the special reference to the nitrogen supply.

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* The following firms coöperated in furnishing the materials: Messrs. H. J. BAKER & BRO., 215 Pearl street, New York; THE BOWKER FERTILIZER Co., 3 Park Place, New York, and 43 Chatham street, Boston; and The MAPES FORMULA AND PERUVIAN GUANO COMPANY, 158 Front street, New York.

THE REPORTS AND THEIR VALUE.

With each set of experimental fertilizers were sent blanks, on which the experimenters were requested, if convenient, to report results. It has been a matter of surprise as well as satisfaction, not only that so many of the experimenters should have taken the pains to make the reports, but also that they should have done this so well. I have received, from the four seasons' experiments, nearly two hundred and fifty of these reports. Some are brief, most are well filled, and many entirely so, while several have additional interesting and suggestive statements covering a number of pages of foolscap, for which there was not room on the blanks. Samples of these reports are given beyond.

The previous accounts have been directed largely to the results of the general experiments, especially in their application to the practical use of commercial fertilizers. It was, however, my feeling from the start that the experiments might gradually be made to assume a more strictly scientific character; that they might be successfully directed toward the study of some of the more abstruse problems of soil fertilization and the nutrition of plants. It was for this purpose that the special experiments were devised, and their results will form the chief topic of the present article. The results of the general experiments, as would be expected, coincide in the main with those of previous seasons. For a general statement of them, therefore, I may refer to the previous reports, and shall incorporate herewith only such facts as are new or of especial importance. As will be seen, however, the outcome of the general experiments adds essentially to that of the special experiments to which attention is at present invited.

The experiments we are discussing bring us face to face with one of the most important problems with which agricultural chemistry has to deal, and at the same time throw some new light upon it. I refer to what may, perhaps, be most properly called

THE FEEDING CAPACITIES OF PLANTS,

Their power of gathering their supplies of food from soil and air, and the effects of different ingredients of plant-food upon their growth.

A vast deal of experience in the laboratory and in the field bears concurrent testimony to the fact, though we are still deplorably in the dark as to how or why it is so, that different kinds of plants have different capacities for making use of the stores of food that soil and air contain. Thus leguminous crops, like clover, do somehow or other, gather a good supply of nitrogen where cereals, such as wheat, barley, rye, and oats, would half starve for lack of it, and this in the face of the fact that leguminous plants contain a great deal of nitrogen, and cereals relatively little. Hence a heavy nitrogenous manuring may pay well for wheat and be in large part lost on clover.

From statements bearing upon this subject in Reports of Experiments in 1878 and 1879, I may, perhaps, be permitted to cite the following:

> As long ago as 1850, Dr. Pusey said in a report "*On the Progress of Agricultural Knowledge during the last Eight Years*" in the Journal of the Royal Agricultural Society (vol. xi. 1850, pp. 385–6), "At present we can only say that the three leading principles of manure are, 1. AMMONIA; 2. PHOSPHORUS; and probably 3. CARBON; and again, "The upshot of the whole is that practically, as far as artificial manures are concerned, we need not dwell upon the mineral ingredients, but must give ammonia to wheat, and to turnips phosphorus." Since Dr. Pusey's time we have got hold of very many new facts, theories of manuring have multiplied, and fertilizers for special crops, based upon various theories, have come into very general use.

THE VILLE FORMULAS AND SYSTEM OF MANURING.

Of the numerous formulas for fertilizers for special crops, no others have attracted so much attention as those of Prof. George Ville of Paris, whose experiments at the Government Farm at Vincennes during twenty-five years or more have been much discussed. These formulas form a part of a "system of manuring" which may be briefly explained as follows:

According to Ville, of the dozen or more constituents of dung, FOUR—nitrogen, phosphate of lime (phosphoric acid), potash, and lime, which constitute about one tenth of its weight—are "the regulators, *par excellence*, of production, and the only ones with which agricultural industry need occupy itself." His formulas for "complete manures" supply these four ingredients—the *nitrogen* as nitrate of potash (saltpeter), nitrate of soda, or sulphate of ammonia; the *phosphoric acid* in the form of superphosphate; the *potash*, in either nitrate of potash, or other potash salts, and the *lime* as sulphate of lime (land plaster). He says that "the mixture of these substances has the same properties as dung." The "complete chemical manure is to the barnyard manure what the metal is to the ore." "It is a farm-yard manure divested of all useless matter." "No one can do any good without the coöperation of the other three (though if either is supplied in abundance by the soil it need not be included in the manure). Given the others, and each has its own predominant action for a certain list of crops.

"DOMINANT INGREDIENTS."

Ville gives "the name *dominant* to the ingredient which, for a given crop, plays a more important part than the others." Thus:

"*Nitrogen* is the predominant ingredient for the cereals, as Wheat, Barley, Rye, Oats, and for Colza, Sugar-Beet, Hemp, etc."

"*Potash* has an especial influence upon Peas, Beans, Clover, Lucern, Flax, Potatoes, etc."

"*Phosphoric acid* is especially beneficial for Turnips, Rutabagas, Radishes, Indian Corn, Sugar cane, etc."

"*Lime* seems to exert no especial preponderating action upon any plant, but is necessary for all."

The practical inference is that in preparing a fertilizer for a given plant, we must reduce the subordinate ingredients as much as we can, and put in a good deal of the dominant. To sustain his propositions, Ville cites a great many experiments, some made by himself in pots or in the fields of the Experimental Farm at Vincennes, and others by farmers in France and elsewhere. From these experiments, Ville infers that nitrogen is the dominant ingredient for wheat and the sugar beet, and consequently he puts a large proportion of it in his formulas for these crops. He insists, furthermore, that the form of combination is important, and uses sulphate of ammonia for wheat, nitrate of soda for sugar-beets, and so on. For clover, beans, peas, etc., he recommends little or no nitrogen, because the plants are found to get very little if any good from nitrogenous manures. He explains this by assuming that such plants get all their nitrogen from the air, and do not need it in fertilizers. Of the theory once held by many, that plants assimilate the free nitrogen of the air, Ville has been for some years almost the only prominent defender. He claims that clover gathers all its nitrogen from the air; that barley and rye get 80 per cent., wheat 50 per cent., and sugar-beet, 60 per cent. from the air, and the rest from the soil.

But by far the most valuable contribution to our knowledge of these subjects comes from the classic

EXPERIMENTS BY MESSRS. LAWES AND GILBERT, IN ENGLAND.

In their experiments, wheat, which has for thirty years received mineral manures alone, has averaged 16¾ bushels per acre yearly, against 14 bushels unmanured. The addition of sulphate of ammonia, with the same repeated cropping of the same land, brought the average up to 36 bushels per acre. The leguminous crops have told just the opposite story. Though they contain a good deal more nitrogen than wheat, they respond but slightly to nitrogen, and are greatly aided by mineral manures. In an experiment on the mixed herbage of grass land, continued through twenty years, mineral manures without potash brought up the total crop 47 per cent., and the nitrogen in the crop 38 lbs. per acre annually above the unmanured. And when potash was added to the mineral manures, the crop was 67 per cent. larger, and contained 56 lbs. more nitrogen per acre than the unmanured, the increase in nitrogen being in large measure due to the leguminous plants which came in under the influence of the potash, and replaced plants of other families.

In one case Messrs. Lawes and Gilbert found that a soil from which a clover crop had just been removed contained more nitrogen than it did before the clover was put in; that, in other words, the soil, to the depth of nine inches at least, was positively enriched by the growth and removal of a highly nitrogenous (clover) crop.

Such facts help to explain why it is such good farm practice to use mineral fertilizers, as plaster, bone, ashes, and potash salts, for mixed grasses and clover; and nitrogenous materials, like guano, sulphate of ammonia, and nitrate of soda, for grain crops. They help us to understand why clover is such an excellent preparatory crop for wheat, and so economical generally for plowing under to bring up poor soils. It gathers and stores plant-food, particularly nitrogen, and thus is itself a fertilizer.

In Messrs. Lawes and Gilbert's experiments, the cereals have been most helped by nitrogen, next by phosphates, and very little by potash; the legumes have responded to mineral manures, especially potash, and paid little heed to nitrogen except where on meadow land they have, under the influence of nitrogenous manuring, gradually run out, and the grasses have taken their place, just as they have replaced the grasses when mineral manures alone were used; turnips have done best with superphosphates; and potatoes, I think, have seemed to demand potash along with nitrogen and phosphates for their best development.

THE RELATION OF THE MAIZE PLANT TO THE NITROGEN SUPPLY.

Doubtless the most important phase of this question is the relation of plants to the nitrogen supply, as is illustrated by the much-vexed question as to the power of the maize plant to gather its nitrogen from natural sources.

Mr. Lawes has written a letter to the Secretary of the New Jersey Board of Agriculture, and also another letter to Mr. Harris, discussing this same question, and insisting, as Mr. Harris also does, upon the need of experiments to test it. He says, "It is of very great importance to know to what extent Indian Corn follows the same law [as the cereals]; that is to say, on a soil which, under a liberal supply of potash and phosphoric acid, will yield 20, 30, or 40 bushels of corn, what increase is obtained by a liberal supply of ammonia or nitrates?"

In his excellent little book, "Talks on Manures," Mr. Harris says: "We know less about the manurial requirements of Indian Corn than almost any other crop we cultivate." The main question is the nitrogen supply—whether, like other cereals (wheat, barley, oats, grasses, etc.), corn has but little power to get nitrogen from natural sources, and requires nitrogenous fertilizers; or, whether, like leguminous plants (clover, beans-peas, etc.), corn can gather the nitrogen for itself; that is, whether corn, is, like wheat, an exhausting crop, or like clover a renovating crop. Mr. Harris is rather inclined to class it with the cereals, but mentions some facts which indicate that in feeding capacity it is more like the leguminous plants. If the latter is the case, then Indian Corn grown and consumed on the farm will, "like clover, enrich the land—the corn will gather up the nitrogen that the wheat crop cannot appropriate, and when the corn and stalks are fed, some 90 per cent. of the nitrogen will be left in the manure."

In a very interesting letter to Mr. Harris, Mr. Lawes discusses this question at length. He is inclined to class corn with the cereals, though he would expect that with mineral fertilizers it would, during its longer period of growth, get more food from soil and air, and especially more nitrogen, and give a larger produce than wheat. At the same time he adds: If wheat and maize were grown continuously for experiment, I should expect that maize, if manured with manure such as wood ashes and superphosphate, would give a larger produce than wheat. But to produce full crops, both would require, in addition, large quantities of nitrogen to be supplied as ammonia or nitric acid."

In illustration of the application of these theories and results of experiments, I may cite several

FORMULAS FOR FERTILIZERS FOR CORN.

In a letter to the Treasurer of the Massachusetts Society for Promoting Agriculture, Mr. Lawes says: "The best possible manure for all the graminaceous crops—wheat, barley, maize, oats, sugar-cane, rice, pasture grass—is a mixture of superphosphate of lime and nitrate of soda."

M. Ville urges what he calls "complete fertilizers," containing nitrogen, phosphoric acid, potash and sulphate of lime, and regulates the proportions by the assumed power of the plant to get its food from soil and air, and the special effects of the different fertilizing substances upon it. Classing corn with sugar-cane, sorghum, turnips, rutabagas, and artichokes, he makes phosphoric acid the "dominant" or most efficient ingredient. Below is his formula for an acre of corn, with the amounts of valuable ingredients and their cost in the forms he recommends. The last column gives the cost in equally good but cheaper materials, like nitrate of soda, guano, bone and potash salts, which, with many important facts in agricultural chemistry, his system curiously ignores.

Prof. Stockbridge, of the Massachusetts Agricultural College, announced some time since a series of fertilizers for different crops, based upon the percentages of nitrogen, phosphoric acid and potash which the crops are found, by analysis, to contain. Thus he recommends for Indian corn:* "To produce 50 bushels of the grain, and its natural proportion of stover to the acre, more than the natural yield of the soil; and in like proportions for other quantities, use"—the formula below. To the formula I append cost of materials as recommended by Prof. Stockbridge, and the cost of same ingredients in cheaper forms, basing estimates here, as elsewhere, upon current market rates, with $5 per ton added for freight and handling.† To resume, we have

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* Report of Mass. Agricultural College, 1876, p. 35.

† The present prices of some of the materials are, however, higher than the above.

Mr. Lawes' Formula.

"The best possible manure," a "mixture of nitrate of soda and superphosphate."

Ville Formula for One Acre.

Materials.	Ingredients.	Cost in formula.	In cheapest form.
Nitrate of potash, 180 lbs.,	Nitrogen, 24 lbs.,	$9.20	$4.80
Acid phosphate of lime, 540 lbs.,	Phos. acid, 81 lbs,	9.45	9.45
	Potash, 79 lbs.,	7.00	3.56
Sulphate of lime, 360 lbs.,	. . . .	1.44	1.44
		$27.09	$19.25

Stockbridge Formula for One Acre.

Materials.		Ingredients.		Cost in formula.	In cheap est form
Sulphate of ammonia,	320 lbs.	Nitrogen,	64 lbs.	$15.20	$12.80
Superphosphate,	248 lbs.	Phos. acid,	31 lbs.	4.34	4.34
Muriate of potash,	154 lbs.	Potash,	77 lbs.	3.46	3.46
				$23.00	$20.60

Mr. Lawes omits and Profs. Stockbridge and Ville supply potash in their formulas. All include nitrogen, Mr. Lawes specifying no quantity, Mr. Ville using but little, and Prof. Stockbridge a very large amount. Ville lays chief stress on phosphoric acid, which he calls the "dominant" for corn, while the Stockbridge formula gives very little of phosphoric acid, and makes nitrogen the most important ingredient.

It is thus evident that men who ought to be well fitted to judge differ very widely in their views upon these most important subjects, and that nothing but actual experiment will bring us the certain knowledge that is needed.

SPECIAL EXPERIMENTS UPON THE EFFECTS OF NITROGENOUS FERTILIZERS.

For the systematic study of this question, a special experimen was devised in 1878, and conducted by a number of gentlemen. Similar series were repeated in 1879, and, with slight variations, in 1880. The plan and purpose of the experiments are set forth in the following statements, prepared for the use of experimenters of the season of 1881, but similar to one sent out to the experimenters of 1880:*

◆

Special Experiments for Nitrogen Tests, 1881.

EXPLANATIONS.

The Object of this experiment is to test the effects of nitrogenous fertilizers in different amounts and combinations upon the growth of the plant, and inferentially its capacity to gather its nitrogen from natural sources.

The Fertilizers.—The ingredients and amounts are such as are used in ordinary practice, Phosphoric acid and Potash being supplied in about the proportions that occur in a corn crop of fifty or sixty bushels, and Nitrogen in one-third, two-thirds, and full amount in same crop.

Forms of Nitrogen.—The Nitrogen is supplied as Nitric Acid in Nitrate of Soda; as Ammonia in Sulphate of Ammonia, and as Organic Nitrogen in Dried Blood.

Quantities of Nitrogen.—The nitrogen is applied at the rate of twenty-four pounds per acre in "one-third ration"; forty-eight pounds per acre in "two-thirds ration"; and seventy-two pounds per acre in "full ration."

Arrangement of Plots and Fertilizers.—The ingredients are supplied as:

Partial Fertilizers,	Group I. Nos. 1—3. each by itself. Group II. Nos. 4—6. Two by two.	Thus testing the effects of ingredients separately, and capacity of soil.
Complete Fertilizers,	Group III. Nos. 7—9. Nitrogen as nitric acid in nitrate of soda. Group IV. Nos. 10—12. Nitrogen as Ammonia in sulphate of ammonia. Group V. Nos. 13—15. Nitrogen as organic nitrogen in dried blood.	Nitrogen in one-third, two-thirds, full ration.

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* The differences betwen the schedule of 1881 and those of the previous seasons are, briefly, as follows :

In the experiments of 1881 nitrogen is supplied in group IV as ammonia, and in group V as organic nitrogen, while in the experiments of 1878 and 1880, as may be seen in table one, the nitrogen is supplied in group IV as "nitrogen" mixture, and in group V in other forms. A further difference is found in group V, which, in 1878 and 1880, supplied the nitrogen as a 2-3 ration, but in 1881 in varying quantities. I may add that, as the result of the experience of three seasons, the arrangement of 1881 seems to me very well adapted to its purpose. This arrangement will very likely be continued for some years to come.

This schedule provides for twenty plots, of which two are unmanured, and eighteen supplied with the experimental fertilizers. Of the latter, three, Nos. 6a, 6b, and 6c are duplicates of the "Mixed Minerals," No. 6. This gives four plots of "mixed minerals," one on each side of each of the three groups, III, IV, and V, in which latter the effects of nitrogen are to be tested. This duplicating the "mixed minerals" serves the three-fold purpose of testing the uniformity of the soil, replacing unmanured plots, and showing more accurately the actual effects of the nitrogen.

DIRECTIONS.

Read carefully the explanations herewith, and the "Directions for the Experiment,"* and "Condensed Directions,"* which go with each set of fertilizers. The main points are to (1.) Select level or nearly level and uniform land. (2.) Lay out the plots accurately (see figures for calculating dimensions in "Condensed Directions"). (3.) Distribute the fertilizers evenly over the plots. (4.) Conduct the experiment carefully, and (5.) Make an accurate report, for which blanks will be sent in due season.

Please indicate the boundaries of the plot, by *strong* stakes, and, if convenient, arrange to *repeat the experiments with the same fertilizers on the same plots through a series of years and crops.*

SIZE OF EXPERIMENTAL FIELD. "ONE ACRE" AND "TWO ACRE" EXPERIMENTS

Experience implies that, under ordinary circumstances, plots of one-twentieth acre each, making one acre for the twenty plots, will suffice. Where convenient, however, it would be well to use two acres. This has been done to advantage when two crops, as corn and potatoes, have been grown side by side on each plot for comparison, an excellent plan for testing the comparative feeding capacities of the plants.

If practicable leave an unmanured strip, say three feet wide, between each two plots, to prevent the roots of each from feeding on fertilizers of the next. This will increase the whole area, but will make the experiment much more valuable.

KIND OF CROP.

The kind of crop will, of course, be selected by the experimenter. Experiments are needed upon all our ordinary crops, but especially on wheat, barley, rye, oats, corn, sorghum, grass, clover, onions, potatoes, roots, and in the South, sugar cane and cotton.

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* See Appendix C., Note 1.

EXPERIMENTAL FERTILIZERS.

SPECIAL NITROGEN SET, 1881.

Cost of "Acre Set," $12.00—"Two Acre Set," $22.00.

	MATERIALS.	AMOUNTS	
No.		Acre Set. For 1-20th acre plots.	Two Acre Set. For 1-10th acre plots.
1.	Nitrate of Soda,	7½ lbs.	15 lbs.
2.	Superphosphate,	15 "	30 '
3.	Muriate of Potash,	7½ "	15
4.	Nitrate of Soda,	7½ "	15
	Superphosphate,	15 "	30
5.	Nitrate of Soda,	7½ "	15 "
	Muriate of Potash,	7½ "	15 "
6.	Superphosphate, Mixed	15 "	30 "
	Muriate of Potash, minerals	7½ "	15 "
7.	Mixed minerals, as No. 6,	22½ "	45 "
	Nitrate of Soda,	7½ "	15 "
8.	Mixed minerals, as No. 6,	22½ "	45 "
	Nitrate of Soda,	15 "	30 "
9.	Mixed minerals, as No. 6,	22½ "	45 "
	Nitrate of Soda,	22½ "	45 "
10.	Mixed minerals, as No. 6,	22½ "	45 "
	Sulphate of Ammonia,	5⅝ "	11¼ "
11.	Mixed minerals, as No. 6,	22½ "	45 "
	Sulphate of Ammonia,	11¼ "	22½ "
12.	Mixed minerals, as No. 6,	22½ "	45 "
	Sulphate of Ammonia,	16⅞ "	33¾ "
13.	Mixed minerals, as No. 6,	22½ "	45
	Dried Blood,	11¼ "	22½
14.	Mixed minerals, as No. 6,	22½ "	45
	Dried Blood,	22½ "	45 '
15.	Mixed minerals, as No. 6,	22½ "	45 "
	Dried Blood,	33¾ "	67½ "
6a.	Superphosphate, Mixed	15 "	30
	Muriate of Potash, minerals	7½ "	15
6b.	Superphosphate, Mixed	15 "	30 "
	Muriate of Potash, minerals	7½ "	15 "
6c.	Superphosphate, Mixed	15 "	30 "
	Muriate of Potash, minerals	7½ "	15 "

Nos. 6a, 6b, and 6c, are simply duplicates of Mixed minerals, No. 6.

SPECIFICATIONS.

Materials to be weighed and mixed with greatest possible care and accuracy, put in eighteen bags numbered as above, and each bag furnished with a label stating number and contents per schedule above. *Minimum* percentages as below.

Nitrate of Soda to contain 16% nitrogen; Sulphate of Ammonia 21% nitrogen; Dried Blood, 11% nitrogen.

Superphosphate (dissolved bone black) to contain 15% of soluble, and 16% total phosphoric acid.

Muriate of Potash to contain 50% of potash

No. 6, the mixture of Superphosphate and Muriate of Potash, is designated as "Mixed minerals." This is duplicated in Nos. 6a, 6b, and 6c. The same mixture forms the basis of Nos. 7 to 15 inclusive, which consist of "Mixed minerals," with the addition of nitrogen compounds.

◆

The fertilizers were supplied, in part at cost, and in part gratuitously, by the *Mapes Formula and Peruvian Guano Co.*, to whose interest and enthusiasm in promoting the experiments, especial thanks are due.

Each set of experimental fertilizers was accompanied by directions for use (see above) and a blank on which the experimenters were requested to record their observations and the results obtained. The blanks were sheets of paper 12 × 19 inches in size, with spaces for numerous details as to soil, weather, culture, and produce, which can perhaps be best shown by an example of which one, the report of Mr. Chas. Fairchild, is given in Appendix A.*

The names of the gentlemen who co-operated in the experiments are given, with detailed results of their work, in Appendix B, TABLE I.

Before entering upon the discussion of the special nitrogen experiments, it may be well to present the results of the general experiments, as is done in TABLES II and III, Appendix B.

SPECIFIC EFFECTS OF THE DIFFERENT FERTILIZING MATERIALS.

To make these plainer, Mr. Beamer has prepared what we have got into the way of calling a "Table of Differences," TABLE IV, Appendix B, which shows very clearly the effect of each material—nitrate of soda, superphosphate, and muriate of potash—both when used alone and when mixed with others. The effect of nitrate of soda alone is calculated by subtracting the average yield with no manure from that of the nitrate of soda plot. To find its effect with superphosphate, the yield of the phosphoric acid plot is subtracted from that which had the mixture of the two. The increase with the complete fertilizer over that with the superphosphate and potash salt gives the effect of the nitrate of soda again, and so on. Of course it is understood that these differences in a given case do not express exactly the effect of the nitrogen, phosphoric acid, or potash, nor even that of the fertilizer containing them. The indirect action of the fertilizer counts for something, and the irregularities in the different plots often a good deal more. Indeed, one of the most interesting uses of this table is to show the uniformity or lack of uniformity of the action of the materials on the different plots, and hence the reliability of the experiment. In experiment No. 4, for instance, the plot with nitrate of soda shows 1.4 bushels less corn per acre than that with nothing, while the increase with nitrate of soda on the other plots over the corresponding plots without it, is little or nothing. But when we come to the superphosphate we find an increase of from 11½ to 18 bushels in every case. The potash, on the other hand, brings either a small increase or a decrease on every plot. The results here are very uniform. But in other experiments as No. 26, the figures are very far from uniform. This test of the uniformity of an experiment is a severe one. Any irregularity in the soil or other circumstance that changes the yield of one plot from what it should be is brought into full relief and even exaggerated by these subtractions, and is further multiplied by ten or twenty, or even more in calculating from small plots to yield per acre.

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* For details as to the fertilizers used in the General experiments, see Appendix C, Note 2, and for general remarks upon the tables, Appendix C, Note 3.

This table of differences seems to me well worthy of study. I find myself referring to it always, and generally to it alone, when I wish to find whether an experiment is uniform and reliable, and what are the effects of the different fertilizing materials.

We shall have to recur to the Table of Differences again. Meanwhile let us come back to the effects of nitrogen in the general and the special experiments together. This will be facilitated by the summary of the special nitrogen experiments in TABLE V (Appendix B).

The questions before us are:

1st. How do the crops experimented with get on with the "mineral" fertilizers, the superphosphate and potash salt.

2d. More especially, how do they respond to nitrogen when added, in different forms and amounts, to the mineral fertilizers.

3d. And finally, what inferences may we draw as to the feeding capacities of the plants, their power to gather their food from soil and air, and the effects of different materials upon their growth, especial reference being made to the nitrogen supply ?

EFFECTS OF NITROGENOUS FERTILIZERS UPON CORN.

Estimating a bushel of corn, with its cobs and stalks, to contain 1⅓ lb. of nitrogen, and to be worth 80 cents, the effects of the nitrogenous fertilizers in the Special and in the General experiments may be summarized as follows, remembering that the superphosphate and potash salt, "mixed minerals," supplied the amounts of phosphoric acid and potash in a crop of not far from 55 or 60 bushels, which would also contain about the 72 lbs. of nitrogen:

AVERAGE RESULTS OF EXPERIMENTS WITH CORN IN 1878, 1879, 1880

BUSHELS OF CORN AND POUNDS OF NITROGEN IN CROP PER ACRE.

11 *Special Experiments.*	*Corn, bushels.*	*Nitrogen pounds.*
"Mixed minerals" alone	45.2	60.4
Same+24 lbs. nitrogen	54.5	72.7
Same 48 lbs. nitrogen	55.4	73.8
Same 72 lbs. nitrogen	56.7	75.6
75 *General Experiments.*		
"Mixed minerals" alone	43.4	57.8
Same+24 lbs. nitrogen	47.8	63.7

In the General experiments the mixture of 300 lbs. superphosphate and 200 lbs. muriate of potash brought, on the average of fifty-three experiments, about 43½ bushels of shelled corn per acre. The Special experiments, however, seem to me a fairer test of what the fertilizers may do, because, while made in all sorts of weather and on worn-out soils, they were nearly all on soils and in latitudes fit for corn, as many of the general experiments were not. In these the mixture of 300 lbs. superphosphate and 150 lbs. of potash salt, which can be bought for $8.25, brought on the average 45 bushels of shelled corn per acre.

The experiments of these seasons bear unanimous testimony to two things: The corn was helped but little by nitrogen in the fertilizers; and it gathered a good deal from natural sources. The increase of crop and of nitrogen in the crop will appear more clearly if we look at it another way.

	In No. of Trials.	WITH NITROGEN.		The Average Increase of Corn was—	The Increase of Nitrogen in the Crop was—
		Amount per Acre.	Contained in Crop of—		
1877–8	29	24 lbs.	18 bushels.	5.9 bushels.	7.9 lbs.
	15	48 “	36 “	7.6 “	9.1 “
	6	72 “	54 “	9.3 “	12.4 “
1879	26	24 lbs.	18 bushels.	5.9 bushels.	7.9 lbs.
	14	48 “	36 “	1.9 “	2.5 “
	6	72 “	54 “	0.3 “	0.4 “
1880	20	24 lbs.	18 bushels.	0.6 bushels.	0.8 lbs.
	24	48 “	36 “	9.0 “	12.0 “
	10	72 “	54 “	14.3 “	19.0 “
1877–8–9–80	75	24 lbs.	18 bushels.	4.1 bushels.	5.5 lbs.
	53	48 “	36 “	6.2 “	7.9 “
	22	72 “	54 “	8.0 “	10.6 “

Or, considering the nitrogen as paying for itself when the value of the increase of crop that came with its use equaled or exceeded the cost of the nitrogen, and expressing the results in dollars and cents·

	In Trials, Total Number.	With Nitrogen Amounts.	Costing.	The Nitrogen paid for itself in trials—	The Nitrogen failed to pay for itself in trials—	The Average Loss in the several trials was—
1877–8	29	24 lbs.	$5.62½	8	21	$0.90
	15	48 “	11.00	1	14	4.45
	6	72 “	16.50	None.	6	8.51
1879	26	24 lbs.	$5.62½	5	21	$0.90
	14	48 “	11.00	1	13	8.48
	6	72 “	16.50	None.	6	16.26
1880	20	24 “	$5.62½	4	16	$2.34
	24	48 “	11.00	9	15	6.04
	10	72 “	16.50	2	8	10.10
1877–8–9–80	75	24 lbs.	$5.62½	17	58	$1.38
	53	48 “	11.00	11	42	6.66
	22	72 “	16.50	2	20	11.62

The nitrogen increased the crop enough to pay its cost in thirty trials out of one hundred and fifty. The pecuniary loss rose and fell with the amount of nitrogen used. With mineral fertilizers alone the crop gathered, by the above estimates, some 60 lbs. of nitrogen per acre.

A REMARKABLE EXCEPTION

to the rule that the corn is able to gather a fair supply of nitrogen for itself and is not much helped by nitrogenous fertilizers occurs in the experiment of Mr. Newton, "K, 1880." Here, every plot without nitrogen was a failure, every one with it gave a large yield, and the produce rose and fell regularly with the amount of nitrogen applied.

Why this was so, I surely cannot tell. A natural explanation —that the soil lacked nitrogen, because it had been lately cropped with oats and rye, and had not the mass of grass roots to supply nitrogen that the old grass lands of many of the other experiments —is not supported by the testimony at hand. In Col. Mead's experiment, "F, 1879," the corn followed oats, and yet got no good from the nitrogen. In several cases in which the experiments have been repeated, corn following corn, with the same fertilizers, upon the same plots, as in Mr. Bartholomew's, "C, 1879" and "1880," the nitrogen was as ineffective the second year as the first. So, likewise, in a similar experiment by Mr. J. W. Sanborn, Farm Superintendent of the New Hampshire Agricultural College, the yield of corn in 1878 was increased, in 1879 diminished, and in 1880 materially injured by nitrogen as sulphate of ammonia.* Mr. Sanborn's corn, like that of the other experimenters who have been repeating their trials, has been as persistent in doing well with mineral fertilizers alone, and getting its own nitrogen, as it has in refusing to respond to nitrogen in fertilizers.

WHERE AND HOW DOES CORN GET ITS NITROGEN?

This is a question I cannot answer. The prevailing opinion among agricultural chemists for some time, and one which I have shared, has been that plants get nearly all their nitrogen from the soil and very little from the air. But there are many facts which are very hard to explain on this theory, and I am, with many others, coming to suspect very strongly that plants do, somehow or other, get considerable nitrogen from the air. It may not be out of place to add that one of the public-spirited agriculturists of our State, Hon. J. W. Alsop, M.D., of Middletown, has undertaken to furnish appliances and defray the expenses of some series of experiments in his greenhouse and our laboratory, with a view of obtaining some more light on this important question.

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*Mr. Sanborn's results are extremely interesting. I regret that I have not full accounts of his experiments (which are soon to appear) for quotation here. Mr. Sanborn writes me, that for corn he finds sulphate of ammonia, the only form of nitrogen he has used in the experiments referred to, "worse than useless," and that the results "grow worse each year that the experiment is repeated," adding very aptly, "Don't ask me why."

THE "DOMINANT" FERTILIZING INGREDIENTS.

It will be interesting to note in how far the theory of "dominant ingredients" is borne out by the experiments. According to Ville the "dominant" for corn is phosphoric acid. The effects of the superphosphate, potash salt and nitrate of soda in the experiments may be stated as follows :

By reference to TABLE IV it will seen that in ten experiments, Nos. 1, 2, 4, 8, 9, 10, 13, 14, 15, and 20, phosphoric acid was decidedly the regulating ingredient, the crop responding uniformly to it, and paying comparatively little attention to the others. In 6 experiments, Nos. 6, 11, 12, 16, 18, and 19, the superphosphate, though not holding relatively so important a place, was more or less useful. In 4 experiments, Nos. 3, 5, 7, and 17, the superphosphate produced little or no effect, the average increase of the several plots of each experiment being less than 4 bushels per acre. The effects of the superphosphate, muriate of potash, and nitrate of soda, estimated in the above manner, may be stated as in the table below, which includes results of experiments of previous seasons.

EFFECTS OF THE FERTILIZING MATERIALS UPON CORN	SUPERPHOSPHATE.				MURIATE OF POTASH.				NITRATE OF SODA.			
	Regulating Ingredient.	More or less efficient.	Inefficient.	Total.	Regulating Ingredient.	More or less efficient.	Inefficient.	Total.	Regulating Ingredient.	More or less efficient.	Inefficient.	Total.
In 27 Experiments of 1878,.........	8	13	6	27	4	13	10	27	..	16	11	27
In 26 Experiments of 1879,.........	8	13	5	26	5	6	15	26	2	10	14	26
In 20 Experiments of 1880,.........	10	6	4	20	1	4	15	20	1	2	17	20
In 73 Experiments of 1878,'79 and '80,	26	32	15	73	10	23	40	73	3	28	42	73

Phosphoric acid took the leading place often, potash occasionally, and nitrogen very rarely. In bad seasons, and on some soils in good seasons, neither material had any effect. The most effective ingredient depended upon soil and season.

IS CORN IN ITS RELATIONS TO NITROGEN MORE CLOSELY ALLIED TO THE CEREALS OR THE LEGUMES?

In relation to this question I can do no better than repeat what was said in last year's report:

> " Our experiments imply that corn shares, to a considerable extent, the power of the legumes for gathering nitrogen from natural sources. One thing, however, detracts from their decisiveness. Most of the trials were on old grass land which contained large quantities of roots on which the corn doubtless fed. How well it could provide itself with nitrogen from nitrogen compounds in the soil and from air without the roots to feed upon is not settled.
>
> "The experiments are numerous and decisive enough to warrant the inference that, as corn is commonly grown, nitrogenous fertilizers in any considerable quantity would be rarely profitable. They imply that corn has somehow or other the power to gather a great deal of nitrogen from soil or air, or both, they imply that in this respect it comes closer to the legumes than the cereals—that, in short, corn may be classed with the renovating crops."

THE FEEDING CAPACITIES OF POTATOES, TURNIPS, AND OTHER CROPS

Our experiments throw some light upon this question, as may be seen from Tables I and IV, and from a comparative summary of average results of all the experiments in Table VI.

Thus, in the experiments of Mr. Bartholomew, No. "C. 1879" and "1880," of Table I, in which corn and potatoes were grown side by side, the corn has responded uniformly and largely to the superphosphate and paid little heed to the other materials, while the potatoes have responded to all. Other experiments on adjacent fields have brought like results. The same thing is observable in the averages of Tables IV and VI. In brief, another season's experiments confirm the statement in last year's report, that,

> "Taking all in all, the potatoes responded to the superphosphate, potash salt, and nitrogenous fertilizers in almost every case where the weather permitted fair growth. None of the other crops except, perhaps, turnips have shown such uniformly beneficial results from all the materials.
>
> The experiments indicate very decidedly that the potato plant differs from many others in respect to the effect of these fertilizing materials upon its growth, and imply that it has less capacity than corn for gathering an

adequate supply of food from natural sources. It seems to demand a full and immediately available supply of nourishment for its successful growth.

Concerning the other crops, the data at hand are too meager to warrant any general conclusions. . . . . . In general, however, the experiments accord with the common notion that makes superphosphate almost a specific for turnips. But they imply that even when the superphosphate is supplied in abundance, the turnip is not usually able to gather enough of the other materials for a full yield unless they are close at hand in readily available forms."

EFFECTS OF NITROGEN IN DIFFERENT FORMS OF COMBINATION.

The figures in TABLES I and V have something to say upon this subject, but the testimony is not as striking in favor of any one form as might, perhaps, have been expected. Thus comparing the increase of corn with nitrate of soda, sulphate of ammonia, dried blood, "nitrogen mixture" (the three named in equal parts,) and in Peruvian guano, on the plots which had 48 lbs. of nitrogen, "two-thirds ration" over the yard with mixed minerals, we have for the averages of 12 experiments the following:

Plot 8.	Nitrate of Soda, 300 lbs.,	corn, 6.6	bushels.
" 13.	Sulphate of Ammonia, 225 lbs.,	" 6.8	"
" 14.	Dried Blood, 450 lbs.,	" 7.5	"
" 11.	Nitrogen Mixture, 300 lbs.,	" 7.1	"
" 15.	Peruvian Guano,	" 7.0	"

NEED OF MORE EXPERIMENTING AND BETTER ELABORATION OF RESULTS.

I hope hereafter to be able to collate the results of the experiments of the three seasons in a more satisfactory manner than has yet been done, so as to make the drawing of just conclusions more practicable. By excluding those in which the crops were spoiled by drouth or other causes, and those whose results are decidedly irregular, I think that summaries like those in TABLES IV, V, and VI will warrant conclusions of no little value.

I hope that the work in the future, of which all that has been previously done seem to me only a beginning, may bring us near the definite information that is so much needed.

EFFECTS OF DIFFERENT FERTILIZERS ON THE QUALITY OF THE CROPS.

The effects of the different fertilizers on the proportion of good to poor corn, and of corn to stalks, are worth noting. A number of experimenters reported the amounts of "good" and "poor" corn. The percentages of "good" corn, i. e., the number of lbs. in 100 lbs. total corn as reported by the experimenters are :

NUMBER OF POUNDS OF GOOD CORN IN 100 POUNDS OF TOTAL CORN, WITH THE DIFFERENT FERTILIZERS.

Number of Experiment.	O. Nothing.	A. Nitrogen.	B. Phosphoric Acid.	C. Potash.	D. Nitrogen and Phosphoric Acid.	E. Nitrogen and Potash.	F. Phosphoric Acid and Potash.	G. Nitrogen, Phosphoric Acid, and Potash.	H. Plaster.	Farm Manures.
2	49	49[6]	68[5]	58[5]	69[6]	60[3]	68[7]	..[5]	..[5]	..
3	69	78	86	88	60	88	63	88	85	..
5	61	71	55	77	84	80	86	90	56	89
8	62	67	84	75	85	58	76	63	58	..
9	69	74	74	63	78	..	79	79	54	..
10	80	72	98	70	87	62	91	92	89	..
12	..	80	88	80	87	88	93	92	90	..
13	88	87	91	88	92	82	94	94	..	..
14	87	89	87	77	80	80	86	86	90	90
17	95	93	97	98	99	99	99	98	99	..
19	97	97	97	97	98	97	98	99	97	..
20	96	95	94	92	97	95	97	97	97	..
Average of 12 Experiments in 1880	71	79	84	79	85	79	86	88	82	90
Average of 14 Experiments in 1879	56	58	72	62	78	64	61	69	63	58
Average of 8 Experiments in 1878	65	67	72	80	72	86	86	85	78	81
Average of 34 Experiments in 1878–80	63	66	76	72	77	74	76	79	72	68

The figures accord with the common experience that the largest yield gives also the largest proportion of good corn. Otherwise, no relation between the fertilizers and the proportions of good and poor corn are discoverable.

RATIO OF STALKS TO SHELLED CORN.

The weighings of corn and stalks were made at different stages of dryness. In some cases the stalks were cut above the ears, in others close to the ground. The results are consequently discrepant. The averages are interesting as showing the relative effects of the fertilizing materials.

NUMBER OF POUNDS OF STALKS TO 100 POUNDS SHELLED CORN.

	O.	A.	B.	C.	D.	E.	F.	G.	H.	
NUMBER OF EXPERIMENT.	Nothing.	Nitrogen.	Phosphoric Acid.	Potash.	Nitrogen and Phosphoric Acid.	Nitrogen and Potash.	Phosphoric Acid and Potash.	Nitrogen, Phosphoric Acid, and Potash.	Plaster.	Farm Manure.
2	464	423	115	127	240	151	288	....	....	....
3	390	223	145	219	406	182	571	291	305	....
4	168	199	92	175	158	159	159	170	158	126
5	118	98	126	123	108	121	154	131	150	85
8	98	86	65	104	91	108	98	130	107	....
9	102	198	96	101	97	....	92	102	99	....
13	129	111	111	147	108	168	124	122	....	....
14	81	122	94	174	94	163	175	174	89	130
16	196	99	106	108	95	83	91	94	101	....
18	118	108	112	116	108	111	109	129	106	....
Average of 10 Experiments in 1880	186	159	106	189	151	188	186	149	142	114
Average of 12 Experiments in 1879	149	156	120	168	105	162	141	124	219	115
Average of 10 Experiments in 1878	173	143	149	145	129	176	128	131	189	133
Average of 32 Experiments in 1878–81	168	153	125	151	127	158	150	133	172	122

The proportion of stalks to shelled corn is smaller in the larger crops, and conversely the poorer crops have more stalks for the same amount of corn than the better crops. Contrary to what is commonly supposed, the nitrogenous fertilizing materials do not seem to have increased the amount of stalks as compared with corn.

REPETITIONS OF EXPERIMENTS IN SUCCESSIVE YEARS.

A summary of results of work of this sort is given in Appendix B, TABLE VII. This is a matter upon which I have laid great stress. But few farmers, however, are inclined to take the trouble needed to repeat the experiments. At the same time I find that many do take the results and practically repeat the work by using the materials they have found, most efficient, on a larger scale. Indeed this seems to be what a great many of the experimenerts do, and to their decided advantage.

DISCUSSION OF INDIVIDUAL EXPERIMENTS.

It is a matter of much regret that such faithful and useful work as has been done by so many of the experimenters must, in lack of space, be passed over with brief general remarks. I cannot, however, forbear calling especial attention to a few of the individual experiments.

MR. BARTHOLOMEW'S EXPERIMENTS,

which have now continued for four years, covered nearly one hundred plots, been repeated on the same plots, with the same fertilizers and the same crop, year after year, and on other parts of the same field, and on contiguous fields and with other crops, are decidedly the most instructive and valuable ever made, to my knowledge, by a private individual in this country. Some, with corn and potatoes, have been reported in TABLE III. I wish here to call especial attention to another experiment with corn, commenced in 1877, and continued until the present. The plots were 10 square rods each. The fertilizing materials have been:

No. of Plot.	FERTILIZERS.				FURNISHING VALUABLE INGREDIENTS.			
	KIND.	Lbs. per Acre.	At price per ton.	Cost per Acre.	KIND.	Assumed per cent.	Lbs. per Acre.	Cost per Acre.
1	Dried Blood..........	320	$40.00	$6.40	Nitrogen..........	10	32	$6.40
2	Dissolved Bone-black,	320	35.00	5.60	Phosphoric Acid..	16	51	5.60
3	Muriate of Potash....	320	45.00	7.20	Potash............	50	160	7.20
4	Dried Blood..........	160	37.50	6.00	Nitrogen..........	5	16	3.20
	Dissolved Bone-black,	160			Phosphoric Acid..	8	25½	2.85
5	Dried Blood..........	106⅔	40.00	6.40	Nitrogen..........	3.3	10⅔	2.13
	Dissolved Bone-black,	106⅔			Phosphoric Acid..	5.3	17	1.87
	Muriate of Potash....	106⅔			Potash............	16.7	53⅓	2.40
6	Plaster..............	320	10.00	1.60				

Wood ashes, dry and leached, and farm manures, were likewise employed, as indicated below. A number of brands of manufactured fertilizers were also tried, with results according with those from the regular experimental fertilizers.

The experimental field is part of that on which Mr. Bartholomew's other experiments have been made. The soil Mr. Bartholomew describes as "hill land, dark loam, moist, with clayey subsoil. The land of this experiment was, in 1874, an old meadow, yielding about one ton of hay per acre. In 1875 it was plowed, dressed with twelve cart-loads per acre of yard manure, planted to corn, and gave 35 bushels per acre. In 1876 it was sowed to oats, with no additional manure ; yield 40 bushels." In 1877 experiments were began with corn. The land has thus been out of grass for six years—one with oats and four with corn. The seasons of 1877 and 1878 were on the whole favorable. In 1879 the spring was late, the crop was injured by storms, and frost killed the corn September 25th, before the corn was matured. The season of 1880 was unusually favorable. The yields per acre have been as follows :

Plot.	FERTILIZER.		YIELD OF SHELLED CORN PER ACRE IN BUSHELS.			
	KIND.	Amount per Acre.	1877.	1878.	1879.	1880.
1	Dried Blood	320 lbs	13.7	10.0	....*	21.2
2	Superphosphate	320 lbs	41.6	39.8	21.7	39.3
3	Muriate of Potash	320 lbs	15.5	11.0	....*	17.5
4	Mixture I + II	160 lbs. of each	38.0	35.4	22.4	37.0
5	Mixture I + II + III	106⅔ lbs. of each	33.5	30.5	20.7	33.3
6	Plaster	320 lbs	19.4	11.0	....*	15.0
0	No Manure		6.2	3.0	....*	13.5
7	Wood Ashes, dry	32 bushels	34.9	30.4	....*	38.8†
8	Wood Ashes, leached	48 bushels	37.7	36.6	24.6†	37.7‡
9	Hog Manure.	16 cart-loads	41.1	46.6	....	37.7
10	Hen Manure	20 bushels	54.9	56.7	...	....

* Entire failure.

† Dissolved Bone-black 480 lbs. per acre, instead of Ashes.

‡ Ammoniated Superphosphate 480 lbs. per acre, in place of Ashes.

When Mr. Bartholomew's experiments were first reported (1877), they were severely criticised. It was alleged that the very striking results obtained with phosphoric acid, and failure of nitrogen and potash to increase the yield, were only transitory; that they did not indicate what would be the results in succeeding seasons, or even on other parts of the same field the same season. Indeed, supporters of certain theories of fertilization with which these and other experiments did not harmonize, went so far as to represent them as utterly fallacious and misleading, and on that account even hurtful to the experimenter and to science.

These criticisms were directed especially to the experiments as tests of the needs of the soil and indications of the proper fertilizers to be used. In Mr. Bartholomew's experiment above, while the yields have naturally varied with the season, the proportions on the different plots from year to year have remained strikingly constant. As in the first season, so in the others to the fourth, the crop has risen and fallen with the phosphoric acid, and paid very little attention to the other ingredients. Indeed, the following statement from the reports of the experiments in 1877 are, with unimportant exceptions, equally appropriate to those of 1880 :

> "(1) In the four cases, Nos. 1, 3, 6, and 0, where phosphoric acid was not supplied, the crop failed. (2) In every case where phosphoric acid was supplied, either alone (*i. e.*, as superphosphate with the lime and sulphuric acid incident thereto), or with other materials in Nos. 2, 4, 5, 8, 9, and 10, the crop was good. (3) The amounts of phosphoric acid per acre in Nos. 2, 4, and 5 were 51, 25½, and 17 lbs., respectively; the yields, 41.6, 38, and 33.5 bushels, showing a corresponding decrease. Comparisons of the amounts of phosphoric acid applied and corn produced in the other cases, of which limited space excludes details, show a similar and singularly uniform ratio between the two. This parallelism between phosphoric acid and yield runs through the plots with ashes, which contain less of the phosphoric acid, and brought less corn; and those with farm manures, which contain more, and brought more. (4) The produce with potash-salt, and with dried blood alone, was less than on the one plot with no manure. (5) While the crop responded uniformly to the phosphoric acid, it got little apparent benefit from the other ingredients of either the chemical fertilizers, the ashes, or the farm manure."

And in all of the scores of trials which Mr. Bartholomew has made in amplification of these experiments, the same results have been obtained; corn has responded largely to phosphoric acid, less to nitrogen, and scarcely at all to potash. I cannot forbear repeating that Mr. Bartholomew has uniformly got the best results by using a moderate dressing of farm manures, supplemented by superphosphates. Indeed, in his case, as in many others, the proper use of commercial fertilizers is to supplement the farm manures. But it should be remembered, that while nitrogen and the potash have produced so little effect on corn, on potatoes they have been as uniformly useful and profitable.

PRACTICAL APPLICATIONS.

It would hardly be permissible to omit reference to the information the experiments give as to what commercial fertilizers farmers may advantageously use. Indeed, it was for this purpose the experiments were at first proposed. The principle, as expressed in previous reports, is briefly this :

> "The chief office of fertilizers is to supply the plant-food that our crops need and soils fail to furnish. It is not good economy to pay high prices for materials which the soil may be made to yield in abundance, or which may be supplied by the carefully-husbanded manures of the farm, but it is good economy to supply the lacking ones in the cheapest way. The most important ingredients of our common commercial fertilizers are *Phosphoric Acid*, *Nitrogen*, and *Potash*, because of both their scarcity in the soil and their high cost. It is in furnishing these that Guano, Phosphates, Bone Manures, Potash Salts, and most other commercial fertilizers are chiefly useful. Accordingly, the three ingredients named were to be supplied (see TABLES II and III) each by itself, two by two, and all three together."

SOILS ESPECIALLY BENEFITED BY PHOSPHORIC ACID.

In Mr. Bartholomew's corn experiment, No. 10, every plot in which phosphoric acid was applied brought a good crop, and every one without it failed. The nitrogen and potash both increased the yield, but, reckoning a bushel of corn with its stalks at 80 cents, neither increased it enough to pay the cost.

In Mr. Clendon's experiment, No. 1,* and Mr. Wolcott's, No. 8, the results with phosphoric acid are equally striking. There are, however, many

SOILS WHICH RESPOND WELL TO POTASH-SALTS.

This is the case with Mr. Hick's experiment with corn, No. 17, and in nearly all the trials with potatoes. I do not find so many striking instances of great success with potash salts, and failure without them in the experiments of this as previous season.

GENERAL CONCLUSIONS.

The following conclusions summarize the main results of the General and Special experiments as applied to the practical use of fertilizers. That they are similar to the conclusions in previous reports is due to the simple fact that the experiments of the different seasons tell essentially the same story.

1. As the experiments were mostly on worn out soils, the average produce with a given crop does not represent what might be expected under fair conditions.

2. The largest yield came with the "complete" Chemical Fertilizer (*G*), which supplies 150 lbs. of nitrate of soda, 300 lbs. of superphosphate, and 150 to 200 lbs. of muriate of potash, at a cost of a little over $15 per acre.

No. G has brought by far the best results. It was generally the most profitable of all with potatoes, and often so with corn and other crops. This mixture has not only brought larger yields than the farm manures, but has also proved more certain, in favorable seasons and in cold, wet, and drouth. I would not propose just these proportions for general use, however. Less potash and more nitrogen would generally be better for some crops, as grain, potatoes and garden vegetables. The object here was to test soils, and not to get the largest possible yields.

3. The next largest average yield is with the farm manures.

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* Mr. Clendon's experiment is of especial interest as illustrating that Phosphoric Acid is sometimes more profitable in its insoluble and cheaper forms, than in Superphosphate. I regret that limited space forbids giving to this subject the notice it deserves, and hope to discuss it elsewhere.

Then follows the mixture of superphosphate and muriate of potash (*F*). This latter averaged most profitable of all for corn.

4. Next came the mixture of nitrate of soda and superphosphate (*E*). That this, which contained superphosphate and nitrate of soda, should bring a lower average yield than the mixture of superphosphate and potash salt with every crop on which the number of trials is large enough to warrant any general conclusions, is certainly a significant fact. Our ordinary guanos, ammoniated superphosphates, and fish manures, contain (like *E*) nitrogen and phosphoric acid with a little or no potash. Nitrogen is the costliest, and potash one of the cheaper of the valuable ingredients of ordinary fertilizers. Another season's experience thus emphasizes last year's statement, that manufacturers and users of ammoniated superphosphate would do well to consider the propriety of either adding potash salts or substituting them for nitrogenous materials in their fertilizers. Indeed, I see many are doing so.

5. These experiments explain very clearly one reason why guano, fish, bone, superphosphates, etc., so often fail. In many cases the trouble is lack of potash.

THE BEST FERTILIZERS FOR DIFFERENT CROPS.

6. To prescribe formulas to fit all cases is utterly impossible. The needs and the effects of the different materials, in any case, are decided by numerous factors, of which the most important are soil, season, tillage, feeding capacity of the crop, and indirect action of the fertilizers. The character of the season cannot be foretold. The wants of the soil can be learned practically by experiment alone. Of the feeding capacities of different crops, much is already known, and experiments like these are telling us much more. As to the indirect action of fertilizers in improving the texture of the soil, and setting plant food free, science has taught us a great deal, but more research will be needed before we shall be able to lay down general rules with certainty.

FORMULAS FOR FERTILIZERS.

7. I am continually receiving requests for formulas for fertilizers for different crops. Several such letters, just received, are before me. I find myself answering, generally, somewhat as follows: "The first and most important thing to be found out is what your soil lacks. That I cannot tell you. It may be phosphoric acid, or

potash; perhaps plaster or lime may serve your purpose, and possibly the trouble may be one that fertilizers will not help, at least not until the soil is drained, irrigated, or better tilled. The best advice I can give is to experiment on a small scale, find what materials are most effective and profitable, and then use them. But if you cannot or will not do this, you can either use guano, phosphate, or bone, or potash salt, and take the risk of its fitting your case; or use a complete fertilizer which contains all the materials that soils generally lack. In the latter case you risk paying for some ingredients that will give no adequate return." But at the same time, it should be said that the general outcome of the experiments is much more favorable for "complete" fertilizers than I anticipated.

As to special formulas for different crops, I make no perscriptions. The intelligent dealers who do so, know very well that it is for their interest to make their mixtures such as will on the average bring the largest practicable profit to the consumer, and are very careful to get the best results of research and experience and use them in preparing their materials. Some I know to be among our most enthusiastic and successful students of these subjects. I can suggest no better formulas than many of those in actual use by trustworthy dealers.

8. Leaving variations in soil and season out of account, and considering the feeding capacity of the crops, as shown by these and other experiments, and by general experience, it is safe to say that:

(1) For *corn*, an excellent fertilizer to bring large crops is a mixture of Peruvian guano, or fish guano, and muriate of potash. To this it might be profitable to add some fine ground bone or superphosphate. In the majority of cases, though not always, a more profitable mixture would probably be one of muriate of potash, with either superphosphate or fine ground bone, or both. At the same time there are cases in which nitrogen helps the crop enough to make it profitable, and in which nitrate of soda, sulphate of ammonia, dried blood, guano, or fish, would be in place.

(2) For *potatoes*, which respond more generally than corn to both nitrogen and potash, such of the above mixtures as contain considerable nitrogen would generally be in order.

AS TO COMMERCIAL FERTILIZERS IN GENERAL.

9. For general farming, at a distance from the large markets, the chief use of commercial fertilizers should be to supplement the manure of the farm. The right way is to make the most and best manure that is practicable upon the farm, and piece out with such commercial fertilizers as experiments and experience prove profitable. At the same time there are many cases, especially near cities, where everything depends upon getting the largest and best yield, and where more exclusive use of chemical fertilizers is advisable.

10. Either the combined testimony of these experiments, similar ones elsewhere, and the best experience are totally false, or chemical fertilizers bring larger, better, and even surer crops than farm manures.

IN CONCLUSION.

Taken all together, the experiments emphasize more and more strongly, year after year, the conclusions expressed in previous reports that:

11. Soils vary widely in their capacities for supplying crops with food, and consequently in their demand for fertilizers.

12. Some soils will give good returns for manuring; others, without previous amendment, by draining, irrigation, tillage, or use of lime, marl, etc., will not.

13. Farmers cannot afford to use commercial fertilizers at random, and it is time they understood the reason why.

14. The right materials in the right places bring large profits. Artificial fertilizers, rightly used, must prove among the most potent means for the restoration of our agriculture.

15. The only way to find what a soil wants is to study it by careful observation and experiments.

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	CREASE WITH LASTER.	INCREASE WITH MURIATED POTASH.				
	Sulphuric Acid and Lime, over No Manure.	Potash, 100 lbs., over No Manure.	Potash, 100 lbs., + Nitrogen, over Nitrogen alone.	Potash, 100 lbs., + Phosphoric Acid, over Phosphoric Acid alone.	Potash, 100 lbs., + Nitrogen + Phosphoric Acid, over Nitrogen + Phosphoric Acid.	Average increase from Potash.
	....	.3	2.2	−1.1	....	.3
	....	2.2	....	.1	3.7	....
	13.8	9.5	8.9	−19.2	8.3	1.9
	2.5	1.5	6.7	.1	0.0	2.1
	−2.8	8.4	1.9	10.5	1.4	5.6
	....	2.2	2.0	−5.2	9.7	3.7
	0.0	10.5	2.3	−5.5	−10.8	−.9
	3.6	−2.1	−1.2	5.6	5.1	1.9
	−4.9	−2.1	....	2.6	7.5	2.7
	....	2.5	−.5	2.9	−1.9	.8
Arranged	6.8	15.2	9.4	2.6	1.2	7.1
th	15.0	15.3	.0	1.5	−11.3	1.1
	....	−2.4	−2.1	−.3	6.6	.5
	.9	−12.0	−5.8	−1.2	6.4	−3.2
	10.5	14.2	5.7	4.3	−5.7	4.6
	4.2	3.7	7.7	12.5	8.8	8.2
	....	21.0	21.7	10.6	9.7	15.8
	5.5	−2.0	5.3	10.0	−.5	3.2
	3.1	8.9	.3	−.1	−6.0	.8
	3.7	0.0	3.3	−.8	8.6	2.8
Average of	4.4	4.7	3.8	1.5	4.0	3.1
Average of	5.1	3.7	4.1	3.7	3.1	6.2
Average of	4.3	8.7	9.2	9.4	9.5	9.2
Average of	4.1	7.7	5.8	5.2	7.0	7.8
	6.3	−1.4	−2.1	36.7	48.8	20.5
E	....	5.5	−14.8	−1.9	....	3.7
	−4.7	.9	−5.0	4.0	1.8	.4
	....	38.0	26.5	9.8	46.9	30.8
Arrang	28.7	3.5	....	....	....	3.5
	48.5	−1.7	−2.2	77.7	50.3	31.0

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C. Sage, Conn.,

J. J. Dearing, Ga.,

C. Miller & Son, Vt.,

Edward Hicks, L. I.,

Buel Landon, Vt.,

J. M. Manning, Mass.,

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APPENDIX C.

NOTE 1.

Special Nitrogen Experiments.

DIRECTIONS.

To facilitate the proper arrangement of the experiments please note:

The Pamphlet (Report of Field Experiments) which will be sent as soon as printed. This gives results of experiments in previous years.

The Condensed Directions, which contain *resumé* of these directions and figures for calculating size of field and plots, the whole in convenient form for taking into the field.

The Blank for Report. Observations should be made during the summer, (preferably in small note-book) and recorded with final results of weighings and measurements on this sheet. Suggestions of improvements in these plans are solicited.

EVERYTHING IN ORDER BEFORE STARTING.

1. It is important to have plans complete and clearly in mind, and everything ready before starting. Proper plans at the outset; uniform soil, which should also be "worn-out" if its permanent capacity for production is to be tested; plots of proper size, shape, and accurately laid out; right application of the fertilizers; good seed; careful measurement of crops; full notes of details; and careful observation of the effects of the fertilizers on succeeding crops, are essential to the best results.

SELECT UNIFORM SOIL.

2. Select soil as nearly uniform in quality as possible. There will be more or less variation in different parts of the same field at best. The less there is of this the more reliable will be the experiments. Level land should be chosen if practicable, but if it be sloping let the plots run up and down the ascent, so that wash by rains will not transfer the materials from one plot to another. Of course the portion chosen for experiment should be a fair sample of the whole field.

"WORN-OUT" SOILS FOR SOIL TESTS.

3. The object is to learn what can be done by the soil with its "natural strength," not with a store of plant food, which has been

either accumulated by natural processes or left over from previous manuring, and which would obscure the action of the fertilizers, and make the experiments less decisive.

LAY OUT PLOTS ACCURATELY.

4. Lay out the whole experimental area and the individual plots as accurately as practicable. Strong stakes should be driven firmly into the ground at the boundaries and not allowed to be knocked over or plowed up.

LONG NARROW PLOTS.

5. Make the plots as long as practicable, so as to compensate as far as possible for the unevenness of the soil. To this end let the whole area be as long and narrow as convenient, and the plots run lengthwise through it. If the seed is to be planted in rows the length can be adapted to the distance of the rows apart. If this space is less than two and one-half feet an unmanured row had better be left between each two strips. In general, an unmanured strip at least two, and better three, feet wide should be left between each two plots, so as to prevent the crop of one from being affected by the manure of another. If this is too inconvenient, the next best plan will probably be to cultivate between the rows deep enough to cut the roots and prevent them from feeding on their neighbor's fertilizers.

If the soil is even, small, short plots will do. But generally it will not be even, and long strips are therefore safer. See "Condensed Directions" for figures for calculating dimensions of plots.

FERTILIZERS WELL DIFFUSED THROUGH SOIL.

6. The fertilizers may be applied broadcast, or if more convenient, they may be put in the hill or drill, *provided they are well diffused through the soil.* To accomplish this, they had better be diluted with several times their bulk of earth before using. The important points are, that they may be:

1st. Applied evenly over the plots where they belong and not allowed to get outside.

2d. Well distributed through the soil.

Experiments with concentrated fertilizers are often spoiled, just as crops are injured or lost through wrong application. Farmers are apt to think the manure must be put close to the seed or the plant will not get the benefit of it. This is wrong. It is not the just germinated plantlet that needs the manure, but the plant, from the time it is well started until its growth is done. We want not only to give the crop a good start, but to help it out on the home-stretch as well. The roots and their branching rootlets run out in all directions in search of food, and the fertilizers ought to be where as many of the rootlets as possible can get at them. If we distribute the fertilizers as well as we can, the water in the soil, aided by the chemical and physical forces that nature keeps in operation, will do the rest. In illustration of this remember how well barn-manure acts, when applied as a top-dressing long before the seed is put in.

But if we concentrate the fertilizers in one place, fewer roots will get them, and these may be injured by coming in contact with them or with their concentrated solutions in the soil. The roots will find their way to the manure and develop more where it lies, it is true, still we should not oblige them to huddle together in one place, but should rather encourage them to spread around, where, with the increased capacity the fertilizer gives them, they can get the more from the soil. Roots join with other natural agents in rendering inert stores of plant food available.

Above all, do not let the fertilizers come too close to the seed. A coarse, dilute material like yard manure may do the plants no harm, but such concentrated fertilizers as potash salts, dried blood, or high-grade superphosphates may kill them.

Since in these experiments it is particularly important that the effect of each fertilizer be fairly tested, it would be well to *mix them with three or four times their bulk of mellow earth before applying.* If the latter is rich in vegetable mould, so much the better. Moist sawdust may be used in place of earth, if more convenient. Do this by all means if applied in the hill or drill. It will be well to even off the ground by a shallow plowing and harrowing, spread the fertilizers evenly over the plots, and then work them in with a good deep-running harrow, or turn them under by very shallow plowing. When the plots are accurately staked out and the fertilizers carefully applied and worked in, the plow or harrow may be run *across* the plots without fear of transporting the fertilizers from one to another. Apply as long as possible before planting. When the seed is in hills or drills an excellent plan is to spread the fertilizers over a space say two feet wide along the row.

UNMANURED PLOTS FOR COMPARISON.

7. It is of the greatest importance that unmanured plots be left for comparison. These and the duplicated "mixed minerals" will test the uniformity of the soil. You will have very little idea how uneven an apparently uniform soil may be until you make the trial.

OTHER FERTILIZERS TO BE TRIED.

8. It will be well to try other materials along with the experimental fertilizers. Guano, fish, ashes, lime, farm-manures, etc., are to be recommended.

REPORTS.

9. Will you please make your reports as full and accurate as convenient? Early forwarding will materially facilitate the collation and publication of results.

Special Nitrogen Experiment.

PLAN OF EXPERIMENTAL FIELD.

With "Acre Set." Each plot $\frac{1}{20}$ acre.
Whole field one acre.
With "Two Acre Set." Each plot $\frac{1}{10}$ acre.
Whole field two acres.
} *Or more with unmanured strips between each two plots.*

	0	No Manure.
GROUP I..	1	Nitrate of Soda.
	2	Superphosphate.
	3	Muriate of Potash.
GROUP II.	4	Nitrate of Soda and Superphosphate.
	5	Nitrate of Soda and Muriate of Potash.
	6	Superphosphate and Muriate of Potash. "Mixed Minerals."
GROUP III	7	Mixed Minerals plus Nitrate of Soda. $\frac{1}{3}$ Ration.
	8	" " Nitrate of Soda. $\frac{2}{3}$ "
	9	" " Nitrate of Soda. Full "
	6*a*	Mixed Minerals. Duplicate of No. 6.
GROUP IV	10	Mixed Minerals plus Sulphate of Ammonia. $\frac{1}{3}$ Ration.
	11	" " Sulphate of Ammonia. $\frac{2}{3}$ "
	12	" " Sulphate of Ammonia. Full "
	6*b*	Mixed Minerals. Duplicate of No. 6.
GROUP V	13	Mixed Minerals plus Dried Blood. $\frac{1}{3}$ Ration.
	14	" " Dried Blood. $\frac{2}{3}$ "
	15	" " Dried Blood. Full "
	6*c*	Mixed Minerals. Duplicate of No. 6.
	00	No Manure.

To Be Taken Into the Field.

SPECIAL NITROGEN EXPERIMENTS.

CONDENSED DIRECTIONS.

1.—Plans should all be made and everything be ready before starting. Uniform, worn-out soil; plots long and narrow and accurately measured and staked out, and right application of the fertilizers are essential to the best success.

2.—Note below the dimensions determined upon for the whole field and for each plot. The "Plan of Experimental Field" in "Directions" and the figures on other side of this will facilitate the planning of field and plots.

3.—Select a fair average portion of the field to be tested, lay it out as accurately as practicable, and put strong stakes firmly into the ground at the boundaries.

4.—If practicable, leave an unmanured strip, at least two, and preferably three, feet wide between each two plots to prevent the roots from feeding upon their neighbors' fertilizers. If this cannot be done the next best plan will be to plow or cultivate between the plots deeply enough to cut the roots.

5.—Designate each plot by a number, 1, 2, 3, etc., corresponding to the number of the fertilizer. Put a stake opposite each and tie a label to it with the number of the plot and kind of fertilizer. The tags on the bags will serve for labels.

6.—Distribute each fertilizer evenly over its plot, and do not let it get outside. Plans for doing this should be made in advance, to avoid danger of finding the fertilizer all used up before reaching the end of the plot, or having some left over. Please note what was said about mixing the fertilizers well with the soil, especially when put in the hill. Otherwise there may be danger of killing some of the seed and injuring the growth of the rest.

DIMENSIONS OF EXPERIMENTAL FIELD AND PLOTS.

*With " Acre Set." Each plot $\frac{1}{20}$ acre. Whole field one acre.**
*With " Two Acre Set." Each plot $\frac{1}{10}$ acre. Whole field two acres.**

ONE-TWENTIETH ACRE PLOTS—LENGTH AND WIDTH.

To calculate the size of plot of $\frac{1}{20}$ acre (for "Acre Set"), find in the left-hand column "Width," the figure for the width you have decided upon, the opposite figure in the right-hand column will represent the length. Or, given the length in the right-hand column, the opposite figure in the left-hand column will be the width. For $\frac{1}{10}$ acre plots ("Acre Set"), take of course double the given length for same width, or double the given width for same length.

Assumed Width.	Required Length.		
RDS.	FT.	=RDS.	FT.
One-third	396	24	
Two-fifths	330	20	
One-half	264	16	
Three-fifths	220	13	5½
FT.	FT.	=RDS.	FT.
6	363	22	
6½	335	20	5
7	312	18	14
7½	291	17	10
8	273	16	8
8½	257	15	9
9	242	14	10
9½	230	15	15
10	218	13	4
10½	208	12	9
11	198	12	

Assumed Width.	Required Length.		
RDS.	FT.	=RDS.	FT.
Two-thirds	198	12	
Three-fourths	176	10	11
Four-fifths	165	10	
One	132	8	
FT.	FT.	=RDS.	FT.
11½	189	11	8
12	182	11	
12½	174	10	9
13	168	10	3
13½	161	9	13
14	155	9	7
14½	150	9	2
15	145	8	13
15½	141	8	8
16	136	8	4
16½	132	8	

For an area of one acre, 160 square rods, 10x16 rods will be good dimensions.* This will make twenty plots—each ½ rod x 16 rods=8 sq. rods.= $\frac{1}{20}$ acre.

ORDER OF PLOTS.

0 No Manure.
1 Nitrate of Soda.
2 Superphosphate.
3 Muriate of Potash.
4 Nitrate of Soda and Superphosphate.
5 Nitrate of Soda and Muriate of Potash.
6 Superphosphate and Muriate of Potash. " Mixed Minerals."
7 Mixed Minerals plus Nitrate of Soda. ¼ Ration.
8 " " " Nitrate of Soda. ½ "
9 " " " Nitrate of Soda. Full. "
6*a* Mixed Minerals. Duplicate of No. 6.
10 Mixed Minerals plus Sulphate of Ammonia. ¼ Ration.
11 " " " Sulphate of Ammonia. ½ "
12 " " " Sulphate of Ammonia. Full. "
6*b* Mixed Minerals. Duplicate of No. 6.
13 Mixed Minerals plus Dried Blood. ¼ Ration.
14 " " " Dried Blood. ½ "
15 " " " Dried Blood. Full. "
6*c* Mixed Minerals. Duplicate of No. 6.
00 No Manure.
Farm manures or other fertilisers.

**Or more with unmanured strips between each two plots.*

NOTE 3.

The Experimental fertilizer used in the General Experimenters were put up in sets of eight small bags. The bags of the "Acre Set" were as below:

FERTILIZING MATERIALS.

Bag. No.	Kind.	Amount.		Valuable Ingredients.	
	ACRE SET.				
A.	Nitrate of Soda	20	lbs.	Nitrogen,	15 per cent.
B.	Dissolved Bone-Black	30	"	Phos. Acid,	15 "
C.	Muriate of Potash	20	"	Potash,	50 "
D.	Nitrate of Soda	15	"	Nitrogen,	5 "
	Dissolved Bone-Black	30	"	Phos. Acid,	10 "
E.	Nitrate of Soda	15	"	Nitrogen,	6.42 "
	Muriate of Potash	20	"	Potash,	28.57 "
F.	Dissolved Bone-Black	30	"	Phos. Acid,	9 "
	Muriate of Potash	20	"	Potash,	20 "
G.	Nitrate of Soda	15	"	Nitrogen,	3.46 "
	Dissolved Bone Black	30	"	Phos. Acid,	6.92 "
	Muriate of Potash	20	"	Potash,	15.38 "
H.	Plaster	20	"	....	

The composition and costs of the fertilizers are more fully stated below. It is assumed that the contents of each bag of the "Acre Set" are applied to one-tenth of an acre. The "price per ton" covers cost of the materials unmixed, in ton lots, at market rates, in 1878, plus $5.00 per ton for freight. Since 1878, when the first experiments with these materials were made and published, the prices of some of the materials have risen, so that the prices given would leave less margin for freight.

EXPERIMENTAL FERTILIZERS.

Number of Bag.	FERTILIZERS USED.				FURNISHING VALUABLE INGREDIENTS.			
	KIND.	Lbs. per acre.	At price per ton	Cost per acre.	KIND.	Amount per cent.	Lbs. per acre.	Cost per acre.
I.	Nitrate of Soda	200	$75.00	$7.50	Nitrogen	16.0	32.0	$7.50
II.	Dissolved Bone-Black.	300	35.00	5 25	Phosphoric Acid,	16.0	48.0	5.25
III.	Muriate of Potash	200	45.00	4.50	Potash	50.0	100.0	4.50
IV.	Nitrate of Soda	150	48.40	10.88	Nitrogen	5.3	24.0	5.63
	Dissolved Bone-Black,	300			Phosphoric Acid,	10.7	48.0	5.25
XIII.	Nitrate of Soda	150	58.00	10.13	Nitrogen	6.6	24.0	5.63
	Muriate of Potash	200			Potash	28.6	10.0	4 50
V.	Dissolved Bone-Black,	300	39.00	9.75	Phosphoric Acid,	9.6	48 0	5.25
	Muriate of Potash	200			Potash	20.0	100.0	4.50
VI.	Nitrate of Soda	150	47.32	15.38	Nitrogen	3 7	24.0	5.63
	Dissolved Bone-Black,	300			Phosphoric Acid,	7.4	48.0	5.25
	Muriate of Potash	200			Potash	15.4	100.0	4.50
VII.	Plaster	200	8.00	.80				

The "Half Acre Set" contained the same materials, but in half the above quantities. The price of the "Acre Set" has been $8.30; of the "Half Acre Set," $5.00.

It has seemed to me that the proportions of the materials above might be advantageously altered so as to give more phosphoric acid, and less potash. I have accordingly proposed some "Improved Sets," to replace the above, which will be used in 1881, and probably thereafter. The "Half Acre Set" is as below:

IMPROVED HALF ACRE SET.

Bag No.	*Kind.*	*Amount.*		*Valuable Ingredients.*
A.	Nitrate of Soda,..................	7½	lbs.	Nitrogen.
B.	Superphosphate,..................	17½	"	Phos. Acid.
C.	Muriate of Potash,...............	7½	"	Potash.
D.	Nitrate of Soda,..................	7½	"	Nitrogen.
	Superphosphate,..................	17½	"	Phos. Acid.
E.	Nitrate of Soda,..................	7½	"	Nitrogen.
	Muriate of Potash,...............	7½	"	Potash.
F.	Superphosphate,..................	17½	"	Phos. Acid,
	Muriate of Potash,...............	7½	"	Potash.
G.	Nitrate of Soda,..................	7½	"	Nitrogen.
	Superphosphate,..................	17½	"	Phos. Acid.
	Muriate of Potash,...............	7½	"	Potash.
H.	Plaster,..........................	20	"	———

NOTE 3.

Concerning the figures in the tables, it may be remarked that:

1. The figures given by the experimenters are followed in all cases except the very few in which minor mistakes were apparent.

2. In some cases the materials were applied to areas different from those recommended. The variations thus made in the amounts per acre, though considerable in some cases, do not materially affect the general result when all are averaged together.

3. The estimates for pounds per bushel of corn and potatoes vary considerably. Corn was generally weighed in the ear, and the shelled corn computed, the different experimenters allowing from seventy to eighty pounds of ears for one bushel of shelled corn. Where the ears were measured, two bushels are reckoned equal to one of shelled corn. I am inclined to think that generally too little allowance was made for the shrinkage that comes in curing. It is evident that the poorer yields appear to an unfair advantage in this way, unless the different qualities of produce are sorted. With corn, for instance, the small yields—those on the unmanured plots and with inefficient fertilizers—would have much larger proportions of poor corn than the good yields. A bushel, or seventy five pounds of poor ears, would give less shelled corn than the same amount of good corn. The small errors thus introduced in the tables appear to the disadvantage of the better fertilizers in the comparison.

I suppose that but comparatively few of the gentlemen whose reports are before me are used to accurate experimenting, and there are doubtless many sources of error in their work which experience in methods of accurate research and more adequate appliances would have eliminated. Two in particular occur to me. One is that the statements of results of weighings and measurements often fail to make due allowance for the quality of the crop. The other is the lack, in the majority of the cases, of unmanured spaces between the plots to prevent the roots of one from feeding in the fertilizers of the other.

For that matter, I can see many imperfections in this method of experimenting. But if we work in the right spirit, experience will be our best teacher, and our errors our most effective lessons. Indeed it seems to me that these trials are only the beginning of what may be developed into work of the greatest value.

NOTE 4.

TABLES I, II, and III contain condensed details as to soil, previous cropping, culture, weather, etc. More complete statements are given by experimenters as shown in the report of Mr. Fairchild's experiment. These fuller details, which lack of space precludes, I hope to be able to present in a future report.

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2

STATE OF CONNECTICUT.

ANNUAL REPORT

OF

The Connecticut Agricultural

EXPERIMENT STATION, New Haven.

For 1880.

PRINTED BY ORDER OF THE LEGISLATURE.

NEW HAVEN:
TUTTLE, MOREHOUSE & TAYLOR, PRINTERS.
1881.

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OF

The Connecticut Agricultural Experiment Station,

1880.

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C. A. HUTCHINSON, B.S., since Sept., 1880.

His Exc. Hobart B. Bigelow, of New Haven, is President of the Board of Control for 1881. The other officers for 1881 are as above.

ANNOUNCEMENT.

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION was established in accordance with an Act of the General Assembly, approved March 21, 1877, "for the purpose of promoting Agriculture by scientific investigation and experiment."

The Station is prepared to analyze and test fertilizers, cattle-food, seeds, soils, waters, milks, and other agricultural materials and products, to identify grasses, weeds, and useful or injurious insects, and to give information on the various subjects of Agricultural Science, for the use and advantage of the Citizens of Connecticut.

The Station makes analyses of Fertilizers and Seed-Tests for the Citizens of Connecticut *without charge*, provided—

1. That the results are of use to the public and are free to publish.

2. That the samples are taken by *consumers* from stock now in the market, and in accordance with the Station instructions for sampling.

3. That the samples are fully described on the Station "Forms for Description."

All work proper to the Experiment Station that can be used for the public benefit, will be made without charge. Work done for the use of individuals will be charged for at moderate rates. The Station will undertake no work, the results of which are not at its disposal to use or publish, if deemed advisable for the public good.

Samples of Commercial Fertilizers, Seeds, etc., will be examined in the order of their coming: but when many samples of one brand or kind are sent in, the Station will make a selection for analysis.

The results of each analysis or examination will be promptly communicated to the party sending the sample. Results that are of general interest will be sent simultaneously to all the newspapers of the State for publication.

The officers of the Station will take pains to obtain for analysis samples of all the commercial fertilizers sold in Connecticut; but the organized coöperation of the farmers is essential for the full and timely protection of their interests. Farmers' Clubs and like Associations can efficiently work with the Station for this purpose, by sending in samples early during each season of trade.

It is the wish of the Board of Control to make the Station as widely useful as its resources will admit. Every Connecticut citizen who is concerned in agriculture, whether farmer, manufacturer, or dealer, has the right to apply to the Station for any assistance that comes within its province to render, and the Station will respond to all applications as far as lies in its power.

☞ Instructions and Forms for taking samples, and Terms for testing Fertilizers, Seeds, etc., for private parties, sent on application.

☞ Parcels by Express, to receive attention, should be prepaid, and all communications should be directed to

AGRICULTURAL EXPERIMENT STATION,
NEW HAVEN, CONN.

P. O. Box, 945.

Laboratory and Office, in East Wing of Sheffield Hall, Grove St., head of College St.

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REPORT OF THE BOARD OF CONTROL.

To the General Assembly of the State of Connecticut:

GENTLEMEN:—The Board of Control of THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION herewith submits to your Honorable Body the Annual Reports of the Director and Treasurer made to this Board at its Annual Meeting held in Hartford, January 18th, 1881.

With the presentation of these Reports we beg leave to state that the work of the Station during the year has gone on without interruption, under the direction of Professor S. W. Johnson, assisted the whole year by Dr. E. H. Jenkins and Dr. H. P. Armsby, and a part of the year by Mr. H. L. Wells and Mr. C. A. Hutchinson. Dr. R. H. Chittenden has also assisted in some special investigations pertaining to animal poisoning.

The Board has held one meeting and its Executive Committee seven meetings during the year.

The last Report of the Experiment Station, by an arrangement with the Board of Agriculture and with the approval of the Comptroller, was bound with the printed Report of that Board and the two were distributed together from the office of the Secretary of the Board of Agriculture at Hartford. That arrangement has been so satisfactory that it is continued this year.

By order of the Board of Control.

HOBART B. BIGELOW,
President.

WILLIAM H. BREWER,
Secretary.

REPORT OF THE TREASURER.

Wm. H. Brewer, *in account with The Connecticut Agricultural Experiment Station.*

RECEIPTS.

Balance from account of 1879,	$527.71	
Laboratory Receipts,	371.45	
From State Treasurer,	5,000.00	
		$5,899.16

PAYMENTS.

Salaries,	$3,967.50	
Travelling expenses of the Board,	57.29	
Printing, Stationery and Postage,	287.75	
Gas,	91.96	
General Laboratory Expenses,	1,108.55	
Furniture, Repairs and Fixtures,	214.96	
Miscellaneous,	38.59	
Cash on hand,	132.56	
		$5,899.16

There is due the Station for Laboratory work, one hundred fifty-eight (158) dollars, which added to the cash on hand, amounts to two hundred and ninety (290) dollars. The bills outstanding against the Station will fully equal that amount.

The Station is in possession of office furniture, apparatus, laboratory stock, seed, plant and other collections, tools, appliances, etc., estimated to be worth thirteen hundred (1300) dollars. That is, it would take that sum or more to replace them or their equivalent.

WM. H. BREWER,
Treasurer.

NEW HAVEN, Jan. 17th, 1881.

T. S. GOLD, } *Auditing Committee.*
W. O. ATWATER, }

REPORT OF THE DIRECTOR.

The pages that follow contain the Fourth Annual Report on the work of this Station, and give an account of its operations for the year 1880.

The Objects and Uses of the Station, and the Privileges which it offers to the citizens of Connecticut, are concisely set forth in the Announcement which is to be found on page 3.

The most important subjects which have engaged attention at the Station during the year 1880, are briefly stated in the paragraphs that immediately follow. Reference to the Table of Contents will direct to their details and show what other topics are considered in this Report.

The analysis and valuation of *Commercial Fertilizers* continues to be the most engrossing employment of the Station. During the eleven months ending Dec. 1, 1880, one hundred and forty-one (141) samples of such fertilizers have been analyzed. Twenty (20) analyses have been made of *Swamp Mucks*, *Soils and Rocks*. Of *Fodder and Feeding Stuffs*, seventeen (17) samples have been examined.

Seven (7) *River and Well Waters* have been tested as to their sanitary condition.

Five (5) specimens of *Market Butter* were analyzed for the purpose of ascertaining whether this article is subject to adulteration.

Four (4) *Vinegars* were tested as to strength and for adulterations.

Nine (9) samples of *Bread* have been examined for alum.

Five (5) poison tests have been made, viz: on a sample of London purple, on corn stover that had been sprinkled when young with Paris Green, and on the stomachs, kidneys or urine of animals that died of poison or under suspicion of it.

In addition to the above specified two hundred and eight (208) analyses, a large amount of work has been done in further study of methods of determining phosphoric acid in quantitative analysis.

Sixty-five (65) *Seed* tests have also been made for the Trade.

Station Bulletins—Fourteen in number—have been printed and sent to each of the eighty-two newspapers published in the State, and also to the Secretaries of the thirty-one Agricultural Societies and twenty-six Farmers' Clubs of Connecticut. The Bulletins have also been supplied by way of exchange to many of the Agricultural Periodicals published in the New England and Middle States, and are regularly re-printed in several of the most widely circulated of these journals. Those who wish to see all of these Bulletins, and at the earliest moment, can find them in the CONNECTICUT FARMER, published weekly at Hartford, to the editor of which I must express my obligations for their first printing and for supplying copies of them for the use of the Station, at a small cost.

After conducting the work of this Station for three and one-half years, I feel it a duty to lay before the General Assembly and the citizens of the State some statements regarding its present efficiency as contrasted with the work which I conceive it ought to accomplish and might easily perform with a moderate increase of its resources.

The Present Resources of the Station.—In its present organization the locality of the Connecticut Agricultural Experiment Station consists of two apartments sixteen by thirty feet, besides an entrance hall, and a small closet, all loaned for its use. One of these larger rooms is its chemical laboratory, the other its office and writing room. Its property consists of the most essential chemical apparatus needed for analytical work and the simplest office furniture and requisites. It has no land and no place where any experiments on soils, plants or animals, under agricultural conditions, can be set up or carried out. The Station owns no books except its own manuscript records, a few copies of its printed Reports and a few volumes of agricultural journals and transactions received in way of exchange.

That the Station thus lives in borrowed lodgings, without grounds or opportunities for agricultural experiments, is not the plan or desire of the Board of Control, but has been necessitated by the limited means at its disposal.

The Wants of the Station.—In its present shape the Station is quite strictly confined to those investigations which can be made in the chemical laboratory, but is debarred from any systematic or serviceable experimental study of the very numerous and most important questions which relate to the wants of soils, crops, or domestic animals, a study which would require ground and the simpler appliances that are employed in practical agriculture.

The analysis of Commercial Fertilizers, which so largely occupies the working force of the Station, accomplishes a single though highly useful purpose, viz: to enable the farmer to know the composition and approximate commercial value of the costly manures that are so largely consumed in our State.

But what is equally important is to know the agricultural value of these fertilizers or their elements, and their economical adaptation to various soils, crops or circumstances. Numerous inquiries are constantly addressed to the Station relating to these topics, to which in many cases no satisfactory answer can be given. In most instances, however, suitably conducted practical experiments would make it possible to answer these inquiries more or less perfectly, and to make valuable additions to our store of knowledge. There are two methods of making such experiments. They may be carried out on a farming scale for a series of years, as has been done at a few places in Europe, notably by Mr. Lawes of England; but thus conducted, their expense is so great and so long a time must usually pass before the useful results appear, that this method is not open to the Experiment Station unless it were transferred to a farm, and provided with five or six times its present amount of funds. Another plan is to make experiments on a small scale in pots or boxes. This method has indeed some drawbacks, but very many advantages. It requires but little ground. By use of a greenhouse, in this sunny climate, experiments may be carried on nearly throughout the year, their number may be cheaply multiplied and results got in a comparatively short time. Furthermore, the influence of disturbing causes, excess or lack of rain or warmth, the ravages of birds and insects, may be more perfectly avoided. By this method a large number of experiments have been made and are constantly making in the European Stations and in this country. Prof. Storer at the Bussey Institution, Dr. McMurtrie at the Department of Agriculture, Washington, and the writer have obtained useful results by its means.

On subsequent pages is given an account of some efforts to ascertain how the nitrogen of swamp muck becomes available to plants, which illustrate the value of this plan of experiment.

To carry on such experiments as a part of Station work would require that the Station should have control of a plot of ground of one or several acres in extent, with unobstructed exposure to sun, and so enclosed as effectually to exclude all intrusion from man and beast.

Furthermore, there would be needed a suitable glass plant-house, with heating arrangements, water, etc., and a skillful gardener would have to be added to the working force of the Station.

The seedsmen of our State are beginning to call upon the Station to test the vitality and purity of their seeds, and to do this at the proper time (in winter) and to the extent which is soon likely to be demanded, a special seed laboratory will be absolutely necessary.

This experimental ground, furthermore, should be the site of the Station Laboratory, because the experiments to be conducted there would require more or less chemical work to be done in preparing for them and in elaborating their results, and would demand the constant oversight of the Director and his assistants throughout all their duration.

The Station should also have lodgings for its gardener and for other responsible assistants within its enclosure, to ensure the undisturbed progress of its investigations.

The Station grounds with these buildings cannot be placed beyond the reach of illuminating gas and water-service pipes, without extreme inconvenience to its garden and laboratories. The Station should therefore be permanently located in some city suburb where it will also be readily accessible to the Post, Express and Telegraph Offices. The chemical laboratory of the Station ought to consist of a room somewhat larger than that now occupied, and should have adjoining a capacious store-room and a smaller furnace room. In connection with its office should be suitable accommodation for a considerable library. It would be extremely desirable also to have space for preserving and displaying specimens of objects having agricultural interest, which fall in the line of its investigations, viz: samples of the seeds of useful and injurious plants and a collection of such plants as might be useful for purposes of comparison and identification. The Station has already in its possession a small but valuable collection of seeds, and a pretty complete herbarium of the grasses and sedges of New England. Samples of rocks, soils, crude and native fertilizing materials and agricultural products of various kinds could readily be kept as an instructive exhibition, if but the place were provided.

A plain brick building with the capacity of a large dwelling house would give the Station good accommodation in all these respects.

To carry on the Station thus equipped in a manner commensurate with the interests involved would require some increase of its funds, for several purposes.

1. To enlarge its laboratory outfit, which is barely sufficient for the analytical work it has had to do, but ought to be considerably extended for profitable working.

2. To establish a working reference library. The Station must be vitally defective unless those who labor in it can have ready and constant access to all the special books, journals and Reports which record the results of investigations in the Experiment Stations of other States and Countries.

3. The Station will need a larger fund for current expenses so soon as it begins to experiment in the field, garden and plant-house.

COMMERCIAL FERTILIZERS.*

In respect to its terms, the Station makes two classes of analyses of fertilizers and fertilizing materials; the first for the benefit of farmers, gardeners, and the public generally; the second for the private use of manufacturers and dealers. Analyses of the first class are made gratuitously, and the results are published as speedily and widely as possible for the guidance of purchasers and consumers. Those of the second class are charged for at moderate rates, and their results are not published in a way to interfere with their legitimate private use. The Station, however, distinctly reserves the liberty to use, at discretion, all results obtained in its Laboratory, for the public benefit, and in no case will enter into any privacy that can work against the public good.

During 1880, one hundred and forty-one (141) samples of fertilizers have been analyzed. Of these, 33 were examined for private parties, and the remainder, 108, for the general use of the citizens of the State.

The samples analyzed for the public benefit have been sent in from various quarters of the State, in most instances by actual purchasers and consumers, but in some instances, by dealers or agents.

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* The matter of this and of several subsequent pages explanatory of the sampling and valuation of fertilizers, is copied with a few appropriate alterations from the Report for 1879.

All the analyses of the first class are made on samples understood to have been taken in accordance with the printed Instructions which the Station supplies to all applicants. Here follows a copy of these instructions.

Instructions for Sampling Commercial Fertilizers.

The *Commercial Value* of a high priced Fertilizer can be estimated, if the amounts *per cent.* of its principal fertilizing elements are known. Chemical analysis of a small sample, so taken as to fairly represent a large lot, will show the composition of the lot. The subjoined instructions, if faithfully followed, will insure a fair sample. Especial care should be observed that the sample neither gains nor loses *moisture* during the sampling or sending, as may easily happen in extremes of weather, or from even a short exposure to sun and wind, or from keeping in a poorly closed vessel.

1. Provide a tea cup, some large papers, and for each sample a glass fruit-can or tin box, holding about one quart, that can be tightly closed, all to be clean and dry.

2. Weigh separately at least three (3) average packages (barrels or bags) of the fertilizer, and enter these *actual weights* in the "Form for description of Sample."

3. Open the packages that have been weighed, and mix well together the contents of each, down to one-half its depth, emptying out upon a clean floor if needful, and crushing any soft, moist lumps in order to facilitate mixture, but leaving hard, dry lumps unbroken, so that the sample shall exhibit the texture and mechanical condition of the fertilizer.

4. Take out five (5) equal cupfuls from different parts of the mixed portions of each package. Pour them (15 in all) one over another upon a paper, intermix again thoroughly but quickly to avoid loss or gain of moisture, fill a can or box from this mixture, close tightly, *label plainly*, and send, charges prepaid, to

The Conn. Agricultural Experiment Station, New Haven, Conn.

The foregoing instructions may be over-nice in some cases, but they are not intended to take the place of good sense on the part of those who are interested in learning the true composition of a fertilizer. Any method of operating that will yield a *fair sample* is good enough.

In case of a fine, uniform and moist or coherent article, a butter-tryer or a tin tube, like a dipper handle, put well down into the packages in a good number of places will give a fair sample with great ease. With dry, coarse articles, such as ground bone, there is likely to be a separation of coarse and fine parts on handling. Moist articles put up in bags or common barrels may become dry on the outside. It is in these cases absolutely necessary to mix thoroughly the coarse and fine, the dry and the moist portions before sampling. Otherwise the analysis will certainly misrepresent the article whose value it is intended to fix.

The quantity sent should not be too small. When the material is fine and uniform, and has been carefully sampled, a pint may be enough, but otherwise and especially in case of ground bone, which must be mechanically analyzed, the sample should not be less than one quart.

It is also important that samples for analysis should be taken at the time when the fertilizer is purchased, and if they cannot be at once dispatched to the Station, they should be so preserved as to suffer no change. Moist fish, blood or cotton seed will soon decompose and lose ammonia, if bottled and kept in a warm place. Superphosphates containing much nitrogen will suffer reversion of their soluble phosphoric acid under similar circumstances. Most of the moist fertilizers will lose water unless tightly bottled, but some of the grades of potash salts will gather moisture from the air and become a slumpy mass if not thoroughly protected.

These changes in the composition of a sample not suitably preserved, must invalidate any conclusions from its analysis, and work serious injustice either to the manufacturer or to the consumer.

It doubtless often happens that a purchaser on laying in a stock of fertilizers, decides that he will not then trouble the Station to analyze the goods he has obtained, but will set aside samples which he can send for examination in case the crops report adversely as to their quality. It is always better to send all samples at once to the Station where they can be directly analyzed or so prepared that they shall keep without chemical change.

With the Instructions for Sampling, the Station furnishes a blank Form for Description of Samples, a copy of which is here given.

FORM FOR DESCRIPTION OF SAMPLE.

Station No.………… Rec'd at Station,…………18

Each sample of Fertilizers sent for gratuitous analysis must be accompanied by one of these Forms, with the blanks *below* filled out fully and legibly.

The filled out Form, if wrapped up with the sample, will serve as a label.

Send with each sample a specimen of any printed circular, pamphlet, analysis, or statement that accompanies the fertilizer or is used in its sale.

Brand of Fertilizer,…………

Name and address of Manufacturer,…………

…………

Name and address of Dealer from whose stock this sample is taken,…………

Date of taking this sample,…………

Selling price per ton or hundred, bag or barrel,…………

Selling weight claimed for each package weighed,…………

Actual weight of packages opened,…………

Here write a copy of any analysis or guaranteed composition that is fixed to the packages.

…………

Signature and P. O. address of person taking and sending the sample.

…………

On receipt of any sample of fertilizer from the open market, the filled out "Form for Description," which accompanies it is filed in the Station's Record of Analyses and remains there as a voucher for the authenticity of the sample and for the fact that it has been taken fairly, or, at least under suitable instructions. It is thus sought to insure that manufacturers and dealers shall not suffer from the publication of analyses made on material that does not correctly represent what they have put upon the market.

The "Form for Description" when properly filled out, also contains all the data of cost, weight, etc., of a fertilizer which are necessary for estimating, with help of the analysis, the commercial value of its fertilizing elements, and the fairness of its selling price. Neglect to give full particulars occasions the Station much trouble, and it is evident that want of accuracy in writing up the Description may work injustice to manufacturers or dealers as well as mislead consumers. It is especially important that the *Brand* of a fertilizer and its *Selling price* should be correctly given. The price should be that actually charged by the dealer of whom it is bought, and if the article be purchased in New York or other distant market, that fact should be stated and the cost at the nearest point to the consumer, on rail or boat, should be reported also.

In all cases, when possible, *ton-prices* should be given, and if the sale of an article is only by smaller quantities, that fact should be distinctly mentioned.

When a sample of fertilizer has been analyzed, the results are entered on a printed form, which is filed in the Station Record of Analyses, facing the "Description of Sample" that was received with the fertilizer to which it pertains, and there remains for future reference.

A copy of the analysis is also immediately reported to the party that furnished the sample, the report being entered on one page of another printed form and facing a second printed page of "Explanations" intended to embody the principles and data upon which the valuation of fertilizers is based.

These Explanations are essential to a correct understanding of the analyses that are given on subsequent pages and are therefore reproduced here, as follows:

EXPLANATIONS OF FERTILIZER-ANALYSIS AND VALUATION.

Nitrogen is commercially the most valuable fertilizing element. It occurs in various forms or states. *Organic nitrogen* is the nitrogen of animal and vegetable matters generally, existing in the albumin and fibrin of meat and blood, in the uric acid of bird dung, in the urea and hippuric acid of urine, and in a number of other substances. Some forms of organic nitrogen, as that of blood and meat, are highly active as fertilizers; others, as that of hair and leather, are comparatively slow in their effect on vegetation unless these matters are reduced to a fine powder or chemically disintegrated. *Ammonia* and *nitric acid* are results of the decay of *organic nitrogen* in the soil and manure heap, and are the most active forms of Nitrogen. They occur in commerce—the former in sulphate of ammonia, the latter in nitrate of soda. 17 parts of ammonia contain 14 parts of nitrogen.

Soluble Phosphoric acid implies phosphoric acid or phosphates that are freely soluble in water. It is the characteristic ingredient of Superphosphates, in which it is produced by acting on "insoluble" or "reverted" phosphates with oil of vitriol. It is not only readily taken up by plants, but is distributed through the soil by rains. Once well incorporated with soil it shortly becomes reverted phosphoric acid.

Reverted (*reduced or precipitated*) *Phosphoric acid*, strictly means phosphoric acid that was once freely soluble in water, but from chemical change has become insoluble in that liquid. It is freely taken up by a strong solution of ammonium citrate, which is therefore used in analysis to determine its quantity. "Reverted phosphoric acid" implies phosphates that are readily assimilated by crops, but generally have less value than soluble phosphoric acid, because they do not distribute freely by rain.

Insoluble Phosphoric acid implies various phosphates not freely soluble in water or ammonium citrate. In some cases the phosphoric acid is too insoluble to be rapidly available as plant food. This is true of South Carolina rock phosphate, of Navassa phosphate, and especially of Canada apatite. The phosphate of coarse raw bones is at first nearly insoluble in this sense, because of the animal matter of the bone which envelopes it, but when the latter decays in the soil, the phosphate remains in essentially the "reverted" form.

Potash signifies the substance known in chemistry as potassium oxide, which is the valuable fertilizing ingredient of "potashes" and "potash salts." It is most costly in the form of sulphate, and cheapest in the shape of muriate or chloride.

The Valuation of a Fertilizer signifies estimating its worth in money, or its trade-value; a value which it should be remembered, is not *necessarily* proportional to its fertilizing effects in any special case.

Plaster, lime, stable manure and nearly all of the less expensive fertilizers have variable prices, which bear no close relation to their chemical composition, but guanos, superphosphates and other fertilizers, for which $30 to $80 per ton are paid, depend chiefly for their trade-value on the three substances, *nitrogen*, *phosphoric acid* and *potash*, which are comparatively costly and steady in price. The money-value per pound of these ingredients is easily estimated from the market prices of the standard articles which furnish them to commerce.

The average Trade-values or cost in market per pound, of the ordinarily occurring forms of nitrogen, phosphoric acid and potash, as found in the Connecticut and New York markets, and employed by the Station during 1879 and 1880, have been as follows:

TRADE-VALUES FOR 1879 and 1880.—*See page* 21.

	Cents per pound.
Nitrogen in nitrates,	26
" in ammonia salts,	22½
" in Peruvian Guano, fine steamed bone, dried and fine ground blood, meat and fish,	20
" in fine ground bone, horn and wool dust,	18
" in fine medium bone,	17½
" in medium bone,	16½
" in coarse medium bone,	15¾
" in coarse bone, horn shavings, hair and fish scrap,	15
Phosphoric acid soluble in water,	12½
" " "reverted" and in Peruvian Guano,	9
" " insoluble, in fine bone and fish guano,	7
" " " in fine medium bone,	6½
" " " in medium bone,	6
" " " in coarse medium bone,	5½
" " " in coarse bone, bone ash and bone black,	5
" " " in fine ground rock phosphate,	3½
Potash in high grade sulphate,	7½
" in low grade sulphate and kainite,	6
" in muriate or potassium chloride,	4½

These "trade-values" of the elements of fertilizers are not fixed, but vary with the state of the market, and are from time to time subject to revision. They are not exact to the cent or its fraction, because the same article sells cheaper at commercial or manufacturing centers than in country towns, cheaper in large lots than in small, cheaper for cash than on time. These values are high enough to do no injustice to the dealer, and properly interpreted, are accurate enough to serve the object of the consumer.

To Estimate the Value of a Fertilizer we multiply the per cent. of Nitrogen, etc., by the trade-value per pound, and that product by 20, we thus get the values per ton of the several ingredients, and adding them together we obtain the total estimated value per ton.

In case of *Ground bone*, the fineness of the sample is graded by sifting, and we separately compute the nitrogen value of each grade of bone which the sample contains, by multiplying the pounds of nitrogen per ton in the sample, by the per cent. of each grade, taking one one-hundredth of that product, multiplying it by the estimated value per pound of nitrogen in that grade, and taking this final product as the results in cents. Summing up the separate values of each grade, thus obtained, together with the values of each grade for phosphoric acid, similarly computed, the total is the estimated value of the sample of bone. For further particulars, see page 28.

The uses of the "*Valuation*" are, 1st, to show whether a given lot or brand of fertilizer is worth as a commodity of trade what it costs. If the selling price is no higher than the estimated value, the purchaser may be quite sure that the price is reasonable. If the selling price is but $2 to $3 per ton more than the estimated value it may still be a fair price, but if the cost per ton is $5 or more over the estimated value, it would be well to look further. 2d, Comparisons of the estimated values and selling prices, of a number of fertilizers, will generally indicate fairly which is the best for the money. But the "estimated value" is not to be too literally construed, for analysis cannot always decide accurately what is the *form* of nitrogen, etc., while the mechanical condition of a fertilizer is an item whose influence cannot always be rightly expressed or appreciated.

The Agricultural value of a fertilizer is measured by the benefit received from its use, and depends upon its fertilizing effect, or crop-producing power. As a broad, general rule, it is true that Peruvian guano, superphosphates, fish-scraps, dried blood, potash salts, plaster, etc., have a high agricultural value which is related to their trade-value, and to a degree determines the latter value. But the rule has many exceptions, and in particular instances the trade-value cannot always be expected to fix or even to indicate the agricultural value. Fertilizing effect depends largely upon soil, crop and weather, and as these vary from place to place and from year to year, it cannot be foretold or estimated except by the results of past experience, and then only in a general and probable manner.

For the above first-named purpose of valuation, the trade-values of the fertilizing elements which are employed in the computations, should be as exact as possible and should be frequently corrected to follow the changes of the market. For the second-named use of valuation, frequent changes of the trade-values are disadvantageous, because two fertilizers cannot be compared as to their relative money-worth, when their valuations are estimated from different data. The greatest good of the greatest number is best served, in an Annual Report, by a middle course, especially since, in such a document, the fluctuations in trade-value that may occur within the year, cannot be accurately followed, and the comparisons of estimated values are mostly in retrospect.

For the year 1881 it is proposed to employ the following revised Trade-Values:

TRADE-VALUES FOR 1881.—*See page* 49.

	Cents per pound.
Nitrogen in nitrates,	26
" in ammonia salts,	22½
" in Peruvian Guano, fine steamed bone, dried and fine ground blood, meat and fish, superphosphates and special manures,	20
" in coarse or moist blood, meat or tankage, in cotton seed, linseed and Castor Pomace,	16
" in fine ground bone, horn and wool dust,	15
" in fine medium bone,	14
" in medium bone,	13
" in coarse medium bone,	12
" in coarse bone, horn shavings, hair and fish scrap,	11
Phosphoric acid soluble in water,	12½
" " "reverted" and in Peruvian Guano,	9
" " insoluble, in fine bone and fish guano,	6
" " " in fine medium bone,	5½
" " " in medium bone,	5
" " " in coarse medium bone,	4½
" " " in coarse bone, bone ash and bone black,	4
" " " in fine ground rock phosphate,	3½
Potash in high grade sulphate,	7
" in low grade sulphate and kainite,	5½
" in muriate or potassium chloride,	3½

The reasons for these changes are to be found in subsequent pages.

ANALYSES AND VALUATION OF COMMERCIAL FERTILIZERS.

The Commercial fertilizers analyzed in the Station Laboratory during the year 1880, are as follows, viz:

38 superphosphates and guanos.
2 Pollard's Privy Guano.

15	ground bone.
17	dried blood, etc.
16	dried fish scrap.
1	horn shavings.
5	castor pomace and cotton seed meal.
4	sulphate of ammonia.
1	nitrate of soda.
8	potash salts.
1	leached wood ashes.
1	unleached wood ashes.
3	plaster.
3	salt kiln-refuse and salt washings.
1	stable manure.
1	vegetable ivory.
24	"special manures" or "formulas" for particular crops.
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Here follow the details of those analyses which have any general interest, together with such remarks as may be useful in explanation.

SUPERPHOSPHATES, GUANOS, &c.

Of thirty-eight samples of this class of fertilizers sixteen were analyzed for private parties.

The twenty-one fertilizers whose analyses follow, whatever may be their trade names, are all superphosphates in the commonly received sense of that word, i. e., they contain soluble or reverted phosphoric acid, as a distinctive ingredient. With one exception, **436,** they contain nitrogen, and in fifteen of them potash is present in a greater or less amount. Their nitrogen is in all cases mostly the nitrogen of fish, blood or other animal matters—so-called organic nitrogen. Their soluble and reverted phosphoric acids are mostly the result of acting on some native phosphate, or on bone with sulphuric acid. Their potash is in all cases due to admixture of some grade of potash salts. While, with the exception of **436,** they are of two kinds in respect to the number and nature of their active ingredients, they are practically of one and the same kind as far as the state and mode of action of these ingredients are concerned, and are alike in being compounded and manufactured of similar raw materials, as well as in the circumstance that they are offered and used for the purpose of applying to crops and soils in general. For these reasons they are classed and tabulated together, so that the consumer may be able easily to make comparisons as to their composition, cost, and estimated value. To facilitate the comparison of cost and valuation, they are arranged in the order in which value exceeds cost or the reverse. In regard to the last two columns of the Table p. 25, it must be remembered that the cost per ton depends somewhat upon the place where they are purchased; the difference, for example, between New York and New Haven prices for articles manufactured or imported at the former place being $1.50 more or less per ton. Prices also usually vary for the same article, according to the quantity sold. Thus one and the same superphosphate was sold at New Haven for $38 per ton and at Bristol at $2.00 per hundred pounds, equal to $40 per ton. On comparing the composition, valuation and cost of the same articles as obtained from different sources at different times, as, for example, **374** with **410**, **378** with **386**, **399** with **412**, **380** with **456**, **430** with **424** and **460**, it is seen that the extreme fluctuation of cost in any of these cases is $2.00 per ton, while the valuation varies from about $0.50 to $3.50 per ton. The differences in the percent of valuable fertilizing ingredients in the same brand are in some instances not inconsiderable, as will be seen by glancing through the columns of the Table on page 26, where in one case, soluble phosphoric acid varies from 2.4 to 4.9 per cent, and in another, potash ranges from 1.9 to 4.6 per cent. In general, however, the samples are fairly accordant in composition, as nearly so, doubtless, as it is possible to make them, for the manufacturer can only get a uniform product when he is able to obtain raw materials of uniform quality.

The differences to which attention has been drawn are, in fact, necessarily more or less incidental to the business of compounding fertilizers out of various raw or waste matters which are themselves variable in their composition.

In round numbers, the average cost of these fertilizers, $39, exceeds the average valuation, $36, by $3. In them, therefore, the average cost of nitrogen, etc., is somewhat greater than the trade-values that have been employed by the Station for these fertilizing elements.

The sample **436**, an imported high-grade superphosphate, without nitrogen, supplies, per ton, 312 pounds of soluble phosphoric acid for $31.55, or at the rate of ten cents per pound.

SUPERPHOSPHATES, GUANOS, &C.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Sent by
436	Superphosphate of Lime, C. B. 15%	Imported.	H. J. Baker & Bros., New York.	J. J. Webb, Hamden.
404	Superphosphate.	Lombard & Matthewson, Warrenville.	Lombard & Matthewson.	J. D. Gaylord, Ashford.
374	"	Quinnipiac Fertilizer Co., New London.	R. B. Bradley & Co., New Haven.	R. B. Bradley.
378	Mapes Complete Manure.	Mapes Formula & Peruvian Guano Co., Newark, N. J.	A. N. Clark, Milford, Ct.	J. W. Nettleton, Milford.
459	Bridgeport Ground Bone (dissolved.)	Manhattan Fertilizer Co., New York and Bridgeport.	F. C. Stickney, Bridgeport, Ct.	F. C. Stickney.
399	Pine Island Guano.	Quinnipiac Fertilizer Co.	R. B. Bradley & Co.	R. B. Bradley.
455	Superphosphate.	E. Frank Coe, New York.	Buck & Durkee, Williamantic.	Buck & Durkee.
373	Fish and Potash.	Quinnipiac Fertilizer Co.	R. B. Bradley & Co.	R. B. Bradley.
411	" "	" " "	S. A. Weldon & Son, Bristol.	S. R. Gridley, Bristol.
386	Mapes Complete Manure.	Mapes Formula & Peruvian Guano Co., Newark, N. J.	Mapes Formula Co., Hartford.	L. S. Wells, New Britain.
384	Ammoniated Bone Superphosphate.	Geo. W. Miles Co., Milford.	Geo. W. Miles Co.	J. W. Nettleton, Milford.
412	Pine Island Guano.	Quinnipiac Fertilizer Co.	S. A. Weldon & Son.	S. R. Gridley, Bristol.
410	Superphosphate.	" " "	S. A. Weldon & Son.	S. R. Gridley, Bristol.
381	"	Lister Bros., Newark, N. J.	A. N. Clark, Milford.	J. W. Nettleton, Milford.
437	Soluble Pacific Guano.	Pacific Guano Co., Boston, Mass.	J. M. Belden, New Britain.	G. M. Barbour, New Britain.
380	Superphosphate.	Russell Coe. Linden, N. J.	E. B. Clark, Milford.	J. W. Nettleton, Milford.
415	"	Bradley, Boston, Mass.	Wilcox & Judd, Bristol.	S. R. Gridley, Bristol.
456	"	Russell Coe, Linden, N. J.	Buck & Durkee, Willimantic.	Buck & Durkee.
430	Manhattan Blood Guano.	Manhattan Fertilizer Co.	R. J. Homes, Plainville.	J. W. Hemingway, Plainville.
424	" " "	" " "	G. H. Staples, Westport.	S. B. Wakeman, Saugatuck.
460	" " "	" " "	F. C. Stickney, Bridgeport.	F. C. Stickney.

SUPERPHOSPHATES, GUANOS, &c.—*Analyses and Valuation.*

Station No.	Name.	Nitrogen.	Soluble Phos. Acid.	Reverted Phos. Acid.	Insoluble Phos. Acid.	Potash.	Estimated value per ton	Cost per ton.	Valuation exceeds cost.
436	C. B. 15 per cent. Superphos.,		15.60	.24	.17		$39.67	$31.55*	$8.12
404	Lombard & M. Superphosph..	3.61	5.10	8.15	2.97		44.83	40.00	4.83
374	Quinn. Fert. Co. Superphos.,	3.31	1.23	7.60	5.57	2.77	40.28	38.00	2.28
378	Mapes Complete Manure, --	3.13	4.86	5.04	2.48	3.30	40.64	40.00	0.64
									Cost exceeds valuation.
459	Bridgeport Dis. Bone, -----	.89	5.18	3.41	5.24		29.99	30.00	.01
399	Pine Island Guano, -------	5.70	.86	4.03	2.42	4.37	39.52	40.00	.48
455	E. Frank Coe's Superphos.,-	2.61	9.14	.55	2.06		37.15	38.00	.85
373	Fish and Potash, ---------	4.25	1.44	3.07	.87	4.65	32.93	34.00	1.07
411	Fish and Potash, --------	4.52	1.27	3.78	1.88	1.92	32.42	34.00	1.58
386	Mapes Complete Manure, --	2.44	2.37	7.34	4.50	3.15	38.32	40.00	1.68
384	G. W. Miles Co. Superphos.,	1.90	6.05	1.65	6.25	1.76	36.03	38.00	1.97
412	Pine Island Guano, -------	4.79	.92	5.57	2.47	4.60	39.09	42.00	2.91
410	Quinn. Fert. Co. Superphos.,	3.22	1.26	6.88	4.68	2.05	36.81	*40.00	3.19
381	Lister Bros. Superphosphate,	2.22	6.84	1.75	2.44		32.55	36.00	3.45
437	Soluble Pacific Guano, ----	3.28	6.93	1.14	2.72	3.98	40.09	46.00	5.91
380	Russell Coe's Superphosph.,	1.13	4.06	2.02	7.30	1.35	29.75	36.00	6.25
415	Bradley's Superphosphate,-	3.06	7.48	.87	1.25	1.46	35.57	**43.00	7.43
456	Russell Coe's Superphosph.,	.84	2.93	2.45	9.60		28.53	38.00	9.47
430	Manhattan Blood Guano, --	2.37	5.57	1.52	6.08	.76	35.33	45.00	9.67
424	Manhattan Blood Guano, --	2.56	5.99	1.10	4.19	.56	33.55	46.00	12.45
460	Manhattan Blood Guano, --	2.47	6.09	.75	2.99	1.29	31.80	45.00	13.20
				Average of 21 samples, --------			$35.95	$39.07	$3.12

* $2.00 per hundred pounds. ** $2.15 per hundred.

COMPARISON OF DIFFERENT SAMPLES OF THE SAME BRAND OF SUPERPHOSPHATE, &C.

		Nitrogen.	Soluble Phos. Acid.	Revert. Phos. Acid.	Insol. Phos. Acid.	Potash.	Estim. Value.	Cost.
Quinnipiac Fertilizer Co's Superphosphate,	374	3.31	1.23	7.60	5.57	3.77	$40 28	$38 00
	410	3 22	1.26	6.88	4.68	2.05	36.81	(40.00)
Mapes Complete Manure,	378	3.13	4.86	5.04	2.48	3.30	40.64	40.00
	386	2.44	2.37	7.34	4.50	3.15	38.32	40.00
Pine Island Guano,	399	5.70	.86	4.03	2.42	4.37	39.52	40.00
	412	4.79	.92	5.57	2.47	4.60	39.09	42.00
R Coe's Superphosphate,	380	1.13	4.06	2 02	7.30	1.35	29.75	36 00
	456	.84	2.93	2.45	9.60		28.53	38.00
Manhattan Blood Guano,	430	2.37	5.57	1.52	6.08	.76	35.33	45.00
	424	2.56	5.99	1.10	4.19	.56	33.55	46.00
	460	2.47	6.09	.75	2.99	1.29	31.80	45.00
Fish and Potash,	373	4.25	1.44	3.07	.87	4.65	32.93	34 00
	411	4.52	1.27	3.78	1.88	1.92	32.42	34.00

POLLARD'S PRIVY GUANO.

The readers of the first Bulletins of this Station will remember that in August, 1877, analyses were published of two so-called "Improved Fertilizers," purporting to be made by Pollard Bros., then of New Haven.

These fertilizers, a "Composition for Grass" and a "Composition for Vegetables," were sold to some extent in the vicinity of New Haven for $32 per ton. They consisted essentially of dried harbor mud, with a little bone dust added, and were commercially worth about $1 per ton.

In January, 1880, the newspapers announced the discovery by H. M. Pollard, of Providence R. I., of a new and valuable fertilizer made from night soil, and soon after a sample of "Concentrated Privy Guano" was brought to the Station by a party who gave his name and address as F. C. Cook, 119 Ellsworth Avenue, New Haven, and who represented the sample to have been sent him by the manufacturers, Pollard & Cook, of Providence. In February the same person brought another sample, which he stated was taken by himself in New Haven from a lot of ten tons which he had purchased for his own use.

These samples were duly analyzed—the first completely, the second partially, and the reports of the analyses were made out in the usual form, signed by me, and mailed to F. C. Cook. On April 3, the analyses were published in Bulletin 38, as follows:

347, 354, Concentrated Privy Guano, manufactured by Pollard & Cook, Providence.

No. **347** sampled by the manufacturers and brought to the Station January 16, by F. C. Cook, 119 Ellsworth Avenue, New Haven.

No. **354** sampled by F. C. Cook, in February, from lot of ten tons purchased by him. Cost, $65 per ton.

COMPOSITION.

	347	354
Moisture	5.10	
Organic Matter, (Nitrogen—0.50)	7.93	
Ammonia (" 4.06)	4.92	
Nitric Acid (" 10.03)	38.70	
Phosphoric Acid, soluble	7.76	
Sulphuric Acid	4.71	
Chlorine	.22	
Soda	2.06	
Potash	24.90	
Lime	3.70	
Magnesia	trace	
	100.00	
Total Nitrogen	14.59	14.29

VALUATION OF 347.

	lbs. per ton.	Val. per lb.	Ton Value.
Nitrogen of Nitrates	200.6	26 cts.	$ 52.15
Nitrogen of Ammonia	81.2	22½ "	18.27
Organic Nitrogen	10.0	20 "	2.00
Soluble Phosphoric Acid	155.2	12½ "	19.40
Potash	498.0	7½ "	37.35
Total Estimated Value			$129.17
Cost			65.00

The analyses were accompanied with the following remarks:

This Privy Guano has an unmistakable privy odor, but unlike night soil, it is almost entirely soluble in water, and unlike both night soil and urine, it consists mainly of nitrates and phosphates of potash, ammonia and soda. It is not manufactured from night soil, although it is flavored with this last-named substance. Its commercial value is almost double its cost, a fact that would be very welcome to the consumers of fertilizers if it could remain a fact. But a "Privy Guano" of this composition cannot long be afforded for much less than $130 per ton, and the extraordinary value of the two samples that thus early have found their way to the Station, should put purchasers on their guard against a sudden and great decline in its composition and value.

Any parties who have laid in a supply would do well to have samples analyzed before waiting for a crop.

In Bulletin 44, issued June 12, 1880, was reported:

The last advices about the Pollard Fertilizers come from Philadelphia, where, according to the letters of an inquiring correspondent, one Dr. H. M. Pollard, representing himself to have been at one time State Chemist to Rhode Island, and afterwards to Massachusetts, has been disposing of the right to make a patent fertilizer, the composition of which is attested by an analysis over the signature of the Director of this Station, giving its value at $127.59 per ton. My correspondent writes that he obtained this information from a party who had agreed to buy the patent right for a certain section of Pennsylvania, for a considerable sum of money, to whom Pollard represented that the fertilizer could be made for $13.56 per ton, and that the right to manufacture it had been sold for Easton, Pa., for $500, and had been negotiated for Allentown and Reading, Pa., and for Baltimore, Md.

It would thus appear that H. M. Pollard "discovered" the Concentrated Privy Guano, and obtained its analysis from this Station for the purposes of a swindling expedition on which he is now engaged.

Finally, in September, inquiry was made at the Station as to the cost of analyzing a sample of guano, or supposed guano, which it was stated had been supplied by H. M. Pollard to parties who had bought the "right" to manufacture for this State. It was further stated that the swindle had been discovered, and that H. M. Pollard had been under arrest for some reason therewith connected.

BONE MANURES.

Method of Valuation.

The method adopted for the valuation of bone manures has been already outlined on page 20. I give here further details.

Experience has led me to distinguish, for the purposes of valuation, five grades of ground bone, the proportions of which are found by a mechanical analysis, *i. e.* by passing a weighed sample of the bone through a system of four sieves. These five grades have the dimensions, and have had, hitherto, the trade-values below specified, viz:

Grade.	Dimensions.	1879 & 1880. Estimated value per pound. Nitrogen.	Phos. Acid.
Fine,	smaller than one 1/50 inch,	18 cts.	7 cts.
Fine medium,	between 1/50 and 1/25 inch,	17¼ "	6½ "
Medium,	" 1/25 and 1/12 inch,	16½ "	6 "
Coarse medium,	" 1/12 and ⅛ inch,	15¾ "	5½ "
Coarse,	larger than ⅛ inch,	15 "	5 "

The chemical and mechanical analysis of a sample of ground bone being before us, we separately compute the nitrogen value of each grade of bone which the sample contains, by multiplying the pounds of nitrogen per ton in the sample by the per cent. of each grade, taking 1/100th of that product, multiplying it by the estimated value per pound of nitrogen in that grade, and taking this final product as the result in cents. Summing up the separate values of each grade, thus obtained, together with the values of each grade for phosphoric acid, similarly computed, the total is the estimated value of the sample of bone.

As an example of the valuation of a bone manure by this method, the following may serve. **92,*** raw bone, from Stepney Bone Mills, Monroe, contained phosphoric acid 20.56 *per cent.* or 411.2 pounds per ton, and nitrogen 3.63 *per cent.* or 72.6 pounds per ton. By the mechanical analysis it showed:

26	per cent.	fine.
23	"	fine medium.
27	"	medium.
24	"	coarse-medium.
0	"	coarse.

The calculations are as follows:

72.6 × 26 ÷ 100 × 18 = $3.40
72.6 × 23 ÷ 100 × 17¼ = 2.88
72.6 × 27 ÷ 100 × 16½ = 3.23
72.6 × 24 ÷ 100 × 15¾ = 2.84
Estimated value of nitrogen = $12.25
411.2 × 26 ÷ 100 × 7 = $7.48
411.2 × 23 ÷ 100 × 6½ = 6.15
411.2 × 27 ÷ 100 × 6 = 6.66
411.2 × 24 ÷ 100 × 5½ = 5.43
Estimated value of phosphoric acid = $25.72
Total estimated value = $37.97

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* Reported in 1878.

This result agreed within $2.00 of the cost ($40.00).

When the sample of bone contains foreign matters introduced as preservatives, dryers or adulterants, such as salt, salt-cake, niter-cake, ground oyster-shells, spent lime, plaster, or soil, these must be taken account of in the mechanical analysis, especially since they would be likely on sifting to pass chiefly or entirely into the finer grades. Lister's Bone usually contains a considerable, sometimes a large percentage of salt-cake; of sample **101***, 54 per cent. passed the finest sieve, but the sample yielded to water 14 per cent. of salt-cake, which mostly passed the finest sieve. In such cases, the several grades as obtained by sifting, must be separately examined and the amounts of foreign matter which they contain must be suitably taken into the account.

In some instances a further source of error in valuation may arise from the fact that the proportions of nitrogen and phosphoric acid are not the same in the finer and coarser portions of a sample, which contains no adulterants, properly speaking, but partly consists of meat, tendon, etc., as is especially the case in certain kinds of "tankings."

There is, however, a limit beyond which it is useless to attempt to refine the processes of valuation. When they become too complicated or costly they defeat the object which they should serve. It is sufficient when the errors of valuation are no greater than those which arise from unavoidable variations in different portions of the same lot of fertilizer, or in different lots of the same brand. A difference of two or three dollars between cost and estimated value cannot ordinarily demonstrate that either is out of the way.

Analyses of Bone Manures.

(See Tables on pp. 32 and 33.)

Fifteen samples of this class have been analyzed, of which fourteen are here reported. As in former years, the valuation of bone manures in most cases exceeds the cost, when the figures adopted in previous reports for the values of nitrogen and phosphoric acid are applied.

Of the fourteen samples, four are to be disregarded in a discussion of cost and valuation. **440,** ivory dust, is exceptional on account of its extreme fineness, dryness and freedom from the sand and dirt which adhere to ordinary bone. It is also exceptional in respect to the small quantity to be had and because its texture is so dense that it probably acts more slowly than ordinary bone of the same fineness. In it, at $30 per ton, the cost of nitrogen per pound is but ten cents and that of phosphoric acid but four cents, while in making the valuation in the table, nitrogen is reckoned at eighteen cents and phosphoric acid at seven cents.

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* Reported in 1878.

427 is a clean quality of bone, sold as cattle food and included here for sake of comparison with **383** and **388**, which are equally fine and rich in phosphates, though not so clean, and with **441**, which agrees almost perfectly with it in composition, is equally clean and pure, but slightly inferior in fineness, and scarcely to be distinguished from it in appearance, while the cost is much less.

Again, **382** is exceptional in composition, as it contains but half the phosphoric acid of the best bone, being mixed with a considerable quantity of salt-cake (sulphate of soda). Excluding, therefore, **440**, **427**, **382** and **443** which is not in market, the average cost of the remaining ten samples is $33.00 and the average valuation is $41.74 per ton. Readers of my report for 1879, will remember that the average cost of eight samples of bone manures there noticed was $32.75 and the average valuation $40.50. In that Report I showed that the cost of bone manures in 1879 would have justified reducing the estimated values of nitrogen and phosphoric acid in this class of fertilizers twenty per cent. below the values employed then and now for superphosphates. It is seen that the analyses of 1880 confirm this result, so that the following comparison between the Station valuation and the cost of the active fertilizing elements of bone manures, holds this year as it did last.

Grade.	Dimensions.	Hitherto estimated value per pound.		Cost per pound in 1879 and 1880.	
		Nitrogen.	Phos. acid	Nitrogen.	Phos. acid
Fine,	Smaller than $\frac{1}{50}$ inch,	18 cts.	7 cts.	15 cts.	6 cts.
Fine-medium,	Between $\frac{1}{50}$ and $\frac{1}{25}$ inch,	17¼ "	6½ "	14 "	5½ "
Medium.	" $\frac{1}{25}$ and $\frac{1}{12}$ inch.	16½ "	6 "	13 "	5 "
Coarse-medium,	" $\frac{1}{12}$ and $\frac{1}{8}$ inch,	15¾ "	5½ "	12 "	4½ "
Coarse,	Larger than $\frac{1}{8}$ inch,	15 "	5 "	11 "	4 "

It is therefore proper to abandon the estimated values* hitherto adopted for the ingredients of bone and to substitute for them the real trade-values or cost per pound of those ingredients as established by the analyses of 1879 and 1880. This substitution will in fact be carried out in 1881. See p. 21.

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* In my first Report I was obliged to adopt the values then currently employed, some of which were sufficiently exact, but others were less so, because of the insufficiency of the data at hand at that time for establishing them.

BONE MANURES.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Sent by
440	Ivory Saw Dust.	F. S. Johnson, Plainville.	Manufacturers.	J. W. Hemingway, Plainville.
441	Bone Saw Dust.	Holyoke Mf'g. Co., Holyoke, Mass.	R. T. Prentiss, Holyoke, Mass.	" "
422	Strictly Pure Ground Bone.	H. J. Baker & Bro., N. Y.	S. B. Wakeman, Saugatuck.	Dealer.
395	" " " "	" " "	Manufacturers.	J. H. Jennings, Green's Farms.
383	Peter Cooper's Ground Bone.	Peter Cooper, N. Y.	E. B. Clark, Milford.	J. W. Nettleton, Milford.
406	Bone.	Edmund Smith, South Canterbury.	Manufacturers.	B. Corbin, Fair Haven.
405	Bone.	Lombard & Matthewson, Warrenv'e.	"	J. D. Gaylord, Ashford.
434	Strictly Pure Ground Bone.	H. J. Baker & Bro., N. Y.	"	J. J. Webb, Hamden.
502	Ground Bone.	Peck Bros., Northfield.	"	S. R. Gridley, Bristol.
388	Bone Meal.	Mapes Form. & Peruvian Guano Co.		L. S. Wells, New Britain.
442	Ground Bone.	Atwood Bros., Watertown.	"	M. S. Baldwin, Naugatuck.
382	Ground Bone.	Lister Bros., Newark, New Jersey.	A. N. Clark, Milford.	Dealer.
427	Bowker's Bone Meal for Cattle.	Bowker Fertilizer Co., N. Y. (?)	Hubbell & Wakeman, Saugatuck.	W. H. Crouch, Saugatuck.
443	Ground Bone, screened from **442**.	Atwood Bros., Watertown.	Manufacturers.	M. S. Baldwin, Naugatuck.

BONE MANURES.—*Analyses and Valuation.*

Station No.	Name or Brand, &c.	Nitrogen.	Phos. Acid.	Finer than				Coarser than 1/6 inch.	Station Valuation.	Cost.	Valuation exceeds cost.	Worth reckoned from average cost of 10 samples.‖
				1/50 inch.	1/25 inch.	1/12 inch.	1/6 inch.					
440	Ivory Saw Dust; Johnson's.	5.42	24.38	94	6				$53.64	$30.00	$23.64	$45.30
441	Bone Saw Dust; Holyoke.	3.64	26.16	87	11	2			49.24	35.50	13.74	41.82
422	Strictly pure ground Bone; Baker's.	4.39	22.17	44	26	30			45.21	32.00	13.21	37.11
395	" " " " "	4.08	22.72	35	30	35			43.62	32.00*	11.62	36.42
383	Peter Cooper's Ground Bone.	1.12	27.38	100					42.36	32.00	10.36	36.22
406	Bone, E. Smith.	4.08	20.99	24	23	21	21	11	39.39	30.00	9.39	32.41
405	" Lombard & Matthewson.	4.05	21.06	18	21	40	21		40.15	32.00	8.15	32.64
434	Strictly pure ground Bone; Baker's.	3.94	19.56	40	29	28	3	1	39.13	31.50	7.63	33.01
502	Ground Bone; Peck Bro's.	4.06	21.79	4	15	30	38	13	38.40	33.00	5.40	31.07
388	Bone Meal; Mapes'.	3.00	25.12	100					45.97	42.00	3.97	39.14
442	Ground Bone; Atwood Bro's.	3.76	20.02	2	11	20	23	44	33.96	30.00	3.96	29.85
	Average of 10 samples.‖								41.74	33.00	8.74	34.97
											Cost exceeds Valuation.	
382	Ground Bone; Lister Bro's.	3.61	13.04	36	20	18	16	10	28.63	30.00	1.37	20.56
427	Bowker's Bone Meal for Cattle.	3.69	26.29	100					50.09	60.00(?)†	9.91†	31.55
443	Ground Bone (screened from 442).	4.29	21.95	27	26	23	14	10	40.80‡			34.51

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* In N. Y., $30.00. † From selected bone ground for Cattle food, sold at $3.00 per hundred. ‡ Not in market. ‖ Exclusive of 440, 382, 427 and 443.

The figures in the last column of the foregoing table are estimated values, reckoned with aid of these revised trade-values, and their fair general agreement with the cost figures, is evidence of their correctness.

The analysis of sample **443** which was screened from bone of the quality of **442**, would seem to show that the softer parts of bone are richer, both in nitrogen and phosphoric acid. This may have been the result of the more perfect drying of the finer part, but the difference of $7.00 in valuation is chiefly due to the difference in the results of the mechanical and not of the chemical analysis.

DRIED BLOOD AND TANKAGE.

Of 17 samples analyzed, 13 were examined for private parties. The other 4 gave results as follows:—

No.	Made by	Sampled by
391 Dried Blood, &c.	Sperry & Barnes, New Haven.	R. E. Pinney, Suffield.
392 " " "	Strong, Barnes, Hart & Co.	" " "
439 " " "	" " " "	J. J. Webb, Hamden.
468 " " "	S. E. Merwin & Co., N. Haven.	J. D. Sage & Sons, Long Hill.

ANALYSES.

	391	**392**	**439**	**468**
Nitrogen,	6.20	8.80	8.25	7.38
Phosphoric acid,	6.02	3.55	6.41	8.27
Estimated value per ton,*	$33.23	$36.65	$41.97	$40.27
Cost per ton,	26.00	?	30.00	35.00
Valuation exceeds cost,	7.23	?	11.97	5.27
Worth reckoned from average cost,**	27.06		34.09	33.54

* Nitrogen reckoned at 20 cts. and phosphoric acid at 7 cts.
** " " " 16 cts. " " " " 6 cts.

Here the average valuation is $38.47, and the average cost $30.31. The difference, $8.16, is twenty-one per cent. of the valuation. Thus it is seen that the trade values of nitrogen and of phosphoric acid in dried blood hitherto used, viz.: twenty cents and seven cents, admit of the same reduction as in bone manures. The phosphoric acid of dried blood and tankage comes mostly from bone, and should therefore, when finely pulverized, properly rank with that of fine bone at six cents per lb. The nitrogen is somewhat more active than that of simple bone, owing to greater subdivision of the substance, and may therefore be reckoned at sixteen cents. The last figures in the table above, are the values thus calculated from the average cost of the samples, and they show that six cents and sixteen cents are high enough valuations for the phosphoric acid and nitrogen, respectively, of this class of goods.

The other analyses of dried blood and so-called azotin, made in 1880, are given below to show the proportions of moisture and nitrogen in these materials as employed by manufacturers in compounding fertilizers. Phosphoric acid was not determined.

DRIED BLOOD AND AZOTIN.

Station No.		Water.	Nitrogen.	Ammonia equiv. to Nitrogen.
343	Dried Blood,	29.88	9.17	11.13
349	" "	24.78	10.10	12.26
350	" "	10.11	10.73	13.03
355	" "	24.78	9.85	11.96
361	" "	20.42	10.53	12.79
368	" "	19.02	9.32	11.32
444	" "	15.10	7.33	8.90
344	Azotin,	8.32	11.95	14.51
353	"	6.65	11.96	14.52
360	"	10.21	10.08	12.24
367	"	8.84	11.90	14.45
369	"	11.27	10.07	12.24
371	"	10.78	10.40	12.39

FISH SCRAP OR FISH GUANO.

Of the sixteen samples examined, but two have been sent in by consumers, viz., **372** and **433**, both made by the Quinnipiac Fertilizer Company of New London. The former was sampled by R. B. Bradley, from stock of R. B. Bradley & Co., New Haven. Cost, $40; valuation,* $44.31. The latter was sampled by E. F. Blake from stock of J. M. Belden, New Britain. Cost, $38; valuation,* $42.75.

The cost of nitrogen and phosphoric acid in these samples is about eighteen cents and six cents, respectively.

The analyses of all the samples (phosphoric acid not determined except in two cases) are given below, with the average composition as found in former years.

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* Nitrogen reckoned at twenty cents and phosphoric acid at seven cents.

ANALYSES OF FISH SCRAP.

Station No.	Designation.	Water.	Nitrogen.	Ammonia equiv. to Nitrogen.	Nitrogen in water-free fish.	Phos. Acid.
372	Dry Fish Guano,	10.16	8.54	10.37	9.50	7.25
408	Fish,	20.85	7.63	9.27	9.51	
429	Dry Fish Guano,	16.26	8.04	9.76	9.60	
433	Dry Ground Fish,		8.14	9.88		7.28
445	Dry Fish Guano,	19.24	8.02	9.74	9.93	
461	Fish Guano,	17.39	8.26	10.03	9.99	
463	" Scrap,	16.55	8.40	10.20	10.06	
466	Dry Fish,	18.78	8.35	10.14	10.28	
478	" "	15.65	7.84	9.52	9.29	
479	Fish Guano,	23.61	7.57	9.19	9.91	
480	" "	20.11	7.86	9.54	9.84	
495	" "	17.87	8.08	9.80	9.83	
498	" "	19.00	7.77	9.43	9.59	
499	" "	21.86	7.30	8.87	9.34	
501	" "	16.11	8.10	9.84	9.65	
504	" "	16.43	7.86	9.54	9.40	
	Average for 1880,	17.99	8.11	9.85	9.89	
	" " 1879,	19.13	7.70	9.34	9.46	
	" " 1878,	14.90	7.65	9.24	7.91	
	" " 1877,	13.66	8.24	10.01	9.36	
	" " 1875 and 1876,	11.78	7.80	9.47	8.84	

BUFFALO HORN SHAVINGS.

432. Sent by J. W. Hemingway from factory of F. S. Johnson, Plainville.

ANALYSIS.

	432
Nitrogen	14.50
Phosphoric Acid	.15
Cost per ton	$30.00
Cost of Nitrogen	10⅓ cts. per lb.

The sample is quite identical in composition with that from the same source reported last year, and the cost of nitrogen in it nearly the same as in coarse bone, i. e., eleven cents.

CASTOR POMACE AND COTTON SEED MEAL.

No.	Name.	Manufacturer.	Dealer.	Sent by
390	Castor Pomace,	Collins Co., St. Louis.	F. Ellsworth, Hartford.	L. S. Wells, New Britain.
398	" "	H. J. Baker & Bro., New York.	Manufacturers,	M. S. Baldwin, Naugatuck.
418	" "	Same.	F. Ellsworth, Hartford.	L. S. Wells, New Britain.
394	Cotton Seed Meal,	------	Smith, Northam & Robinson, Hartford.	R. E. Pinney, Suffield.
402	" " "	------	C. H. Carrington, Naugatuck.	M. S. Baldwin, Naugatuck.

ANALYSES AND VALUATIONS.

Station No.	Nitrogen.	Phos. Acid.	Potash.	Estimated value per ton.	Cost.	Valuation exceeds cost.	Worth reckoned from average cost.
Castor Pomace,							
390	5.73	1.79	1.29	$27.30	$20.00	$7.30	$21.52
398	5.06	1.86	1.02	$24.50	$19.00*	$5.50	$19.24
418	4.64	1.34	.53	$21.45	$20.00	$1.45	$16.88
Average,	5.14	1.66	.95	$24.42	$19.66	$4.75	$19.21
Cotton Seed Meal,							
394	7.20	3.33	2.11	$36.69	$25 00†	$11.69	$28.72
402	6.89	3.49	2.07	$35.69	$30.00	$5.69	$27.89
Average,	7.04	3.41	2.09	$36.19	$27.50	$8 69	$28.30

* In New York. † In 10 ton lots.

The average estimated value exceeds average cost by nearly nineteen and one-half per cent. in case of castor pomace, and by twenty-four per cent. in case of cotton seed meal. The trade values used for reckoning the above valuations were twenty cents for nitrogen, nine cents for phosphoric acid, and four and one-half cents for potash. The same reduction of trade values that we have seen to be justified by the bone manures and by dried blood applies therefore to these fertilizers. Calculating on the basis of nitrogen sixteen cents, phosphoric acid six cents, and potash three and one-half cents we obtain as the average value of castor pomace $19.20, and of cotton seed meal $28.30, which agree fairly with the average market prices, and with the single exception of 418 the valuation thus obtained is above the actual cost of the samples.

The composition and actual value of these samples of cotton seed meal is not essentially different from that of the damaged cotton seed analyzed last year. The cost is more by several dollars per ton.

SULPHATE OF AMMONIA.

The four analyses of this fertilizer were made for manufacturers. The results show the quality of the commercial article. The cost was not made known.

	346	**362**	**370**	**375**
Nitrogen	20.36	20.03	19.84	19.82
Equivalent to Ammonia	24.72	24.31	24.19	24.07
Equivalent to Sulphate of Ammonia	95.98	94.42	93.91	93.49

Sulphate of ammonia is cheaply manufactured as a bye product from the illuminating-gas works, and furnishes more nitrogen in a given weight than any other fertilizer employed in agriculture. Its nitrogen being in the state of ammonia, and the salt itself being freely soluble in water, convenient to handle, and permanent under transport, it is eagerly bought by compounders of fertilizers. It is now manufactured in the large towns of Connecticut, so that consumers have the opportunity to bid for the purchase of it at first hand.

NITRATE OF SODA.

482. From stock of Sisson & Butler, Hartford. Sampled and sent by T. N. Bishop, Plainville.

Nitrogen	15.91
Equivalent to Nitrate of Soda	96.30
Moisture	1.61
Undetermined matters	2.09
	100.00
Calculated value per 100 lbs.	$4.13
Cost	4.50

The cost of nitrogen in this sample is 28¼ cents per lb.

POTASH SALTS.

Muriates.

No.	Importer.	Dealer.	Sent by
387	Mapes Formula and Peruvian Guano Company, New York.	Importers.	L. S. Wells, New Britain.
438	H. J. Baker & Bro., New York.	Importers.	J. J. Webb, Hamden.
509	?	A. Lathrop.	H. H. Austin, Suffield.
		Sulphates.	
389	Mapes Formula and Peruvian Guano Company, New York.	Mapes' Ct. Valley Branch, Hartford.	L. S. Wells, New Britain.
397	H. J. Baker & Bro., New York.	Importers.	M. S. Baldwin, Naugatuck.
428	H. J. Baker & Bro., New York.	Importers.	P. M. Augur, Middlefield.
457	C. V. Mapes & Co., New York.	Mapes' Branch, Hartford.	R. E. Pinney, Suffield.
508	?	A. Lathrop, Suffield.	H. H. Austin, Suffield.

POTASH SALTS.—ANALYSES.

	Muriates.			Sulphates.				
	387	**438**	**509**	**389**	**397**	**428**	**457**	**508**
Potash (potassium oxide),	50.37	52.18	53.83	35.68	49.17	47.37	46.87	27.38
Equivalent to pure muriate,	79.80	82.50	85.25					
" " sulphate,				66.00	91.00	87.50	86.70	50.74
Chlorine,				7.56	none	none	0.40	1.20
Potash guaranteed or implied in brand,	43.23	44.85		37.83	48.64		44.05	27–29
Cost per ton,	$40.00	$40.00	$32.00	$65.00	$72.00*	$65.00	$66.66**(?	$35.00
Estimated value per ton,†	$45.33	$46.96	$48.45	$53.52	$73.76	$71.06	$70.31	$41.07
Cost per 100 lbs. of potash,	$3.97	$3.83	$2.97	$9.10	$7.32	$6.86	$7.11	$6.39
Sent in month of	April	May	Nov.	April	April	May	June	Nov.

* In New York. ** "Cost 3⅓ in Hartford."

† Potash reckoned in muriate at 4½ cts., in sulphate at 7½ cts. per lb.

The fluctuations in the cost of potash are like those noticeable in former years. The samples bought in April and May yield potash as muriate for about four cents, and as sulphate for seven to nine cents; those sent in November furnish potash for three cents and six and one-half cents per lb. It would appear from these data, together with those of last year, that for the purposes of valuation at present three and one-half cents is a fair trade value for potash in muriate and seven cents in sulphate.

WOOD ASHES.

400. Ashes from stock of W. W Cooper, Suffield. Sent by R. E. Pinney, Suffield.

401. Canada Leached Ashes from stock of James A. Bill. Sent by Otis Snow, Rockville.

Sample **400** is apparently unleached ashes, and the analysis closely resembles, in most particulars, one made at this station last year on hickory ashes. The sample has evidently been exposed to wet, and may have lost a portion of alkali. Reckoning in it the potash at seven and one-half cents, lime at one-quarter of a cent (cost at kiln in New Haven), magnesia at two cents, phosphoric acid at seven cents, and sulphuric acid at one-half cent per pound, the estimated value of 100 pounds is $0.57½, while the cost is $0.83. Allowing lime to be worth at Suffield one-half cent per pound, to cover transportation, would raise the valuation to $0.66. On the other hand, considering the potash worth no more than in muriate (four and one-half cents) would reduce the value fourteen cents per hundred pounds. The ashes are thus really worth about fifty to sixty-five cents per 100 pounds, the former price for ordinary crops, the latter for tobacco where muriate of potash is objectionable. The valuation of fertilizers like this sample is less exact than in case of superphosphates, etc., because those ingredients, like lime, which make up a large part of its weight, have very variable commercial values, according to locality and state of market.

	400	**401**
Potash	4.66	1.26
Soda	1.20	.54
Lime	34.02	24.37
Magnesia	2.41	2.43
Iron Oxide and Alumina	1.41	2.13
Phosphoric Acid	1.19	1.26
Sulphuric Acid	.95	.10
Carbonic Acid	19.25	14.99
Silica and Sand	11.11	15.71
Charcoal	6.86	3.11
Moisture expelled at 212°	13.42	32.02
Combined water and loss	3.52	2.08
	100.00	100.00
Carbonate of Lime, equivalent to Lime	60.7	43.6
Weight per bushel	42 lbs.	56 lbs.
The weight per bushel was not stated, but 56 lbs. appears to be the average.		
Cost per bushel	35 cts.	21 cts.
Cost per 100 lbs.	83 cts.	37½ cts.

401 has essentially the composition usually found in leached wood ashes. It contains, indeed, more sand and silica than the average, but also more potash, while lime and phosphoric acid are up to the average.

In previous Reports I have endeavored to ascertain by calculation what mixture of other materials can furnish a substitute for the Leached Ashes that are imported from Canada and so highly valued for their effect on the land and crops. In the hope that my conclusions may be of service to some who have not seen those Reports, and that some of our farmers may take the trouble to make some experiments in this direction and publish the results, I reprint a paragraph from the Report for 1879, which was written with reference to three analyses of Leached Ashes made that year.

"These ashes, applied at the rate of a ton (36 bushels) per acre, furnish, besides a large dose of carbonate of lime (1,100 lbs.), serviceable quantities of potash (20 lbs.), of magnesia (60 lbs.), and of phosphoric acid (30 lbs.); but the chief effects of the application come from the carbonate of lime. With the help of the analyses of oyster-shell lime, we can calculate closely the composition and cost of a mixture which would be equal in all respects, or even superior to these leached ashes. The essential fertilizing matters of 100 lbs. of leached ashes would be contained in

Slacked Oyster-Shell Lime	54 lbs.	costing*	9 cts.
Muriate of Potash	2 "	"	5 "
Ground Bone	8 "	"	12 "
		Total	26 cts.

* At kiln.

One hundred pounds of leached ashes cost, in 1879, on the average, twenty-five cents. Our mixture, however, would contain, in its bone, about four cents' worth of nitrogen which is absent from leached ashes, so that the value of the materials of this mixture is not less than that of the ashes. The mixture would contain hydrate of lime which would make it in most cases a better application to the soil, but might perhaps do damage to the plant unless carefully distributed."

The less cost of the leached ashes analyzed last year (25 cents per bushel on the average) was owing in part at least to the fact that two of the samples were delivered on tide water (for 12½ and 14 cents per bushel). The third sample cost at Canterbury 16½ cents per bushel.

The comparison as to cost between the above mixture and leached ashes at any given locality may easily be made by applying local prices to the reckoning.

LAND PLASTER.

No.	Manufacturer.	Dealer.	Sent by
414	E. B. Alvord, Jamesville, N. Y.	S. A. Weldon & Son, Bristol.	S. R. Gridley, Bristol.
419	George Abbott, Branchville.	Manufacturer.	D. H. Van Hoosear, East Wilton.
431	?	E. N. Pierce, Plainville.	T. N. Bishop, Plainville.

Analyses.

	Pure Gypsum.	**431**	**431**	**419**
Sand and insoluble matters	——	7.48	7.81	3.83
Carbonate of Lime etc. (by diff.),	——	17.08	17.03	2.34
Sulphuric Acid	46.51	35.09	34.96	43.64
Lime	32.56	24.56	24.47	30.56
Combined water	20.93	15.97	15.73	19.63
Hydrated Sulphate of Lime:	100.00	75.44	75.16	93.83
	100.00	100.00	100.00	100.00
Cost per ton		$7.50	$7.00	$ 6.00
One hundred lbs. of pure Gypsum cost		0.50	0.46½	0.32
		at Bristol.	at Plainville.	at Branchville.

419 is doubtless Nova Scotia plaster, and contains 94 per cent., or about the average amount of gypsum (hydrated sulphate of lime or hydrated calcium sulphate) found in that article. **414** and **431** are the plaster of Jamesville, N. Y., containing 75 per cent. of gypsum and 17 per cent. of carbonate of lime.

PRODUCTS OF SALT MANUFACTURE.

357. Refuse Salt Washings.

358. Kiln Refuse.

359. No. 2 Fine Salt.

The above were sampled by the Secretary of the Onondaga Salt Association at Syracuse, N. Y., and were sent to the Station, March 1, by S. A. Smith, Esq., of Cheshire.

Analyses.

	357	**358**	**359**
Chloride of Sodium (salt)	67.92	97.20	98.30
Chloride of Potassium (muriate of Potash)		.54	.54
Sulphates and Carbonates of Lime and Magnesia	29.58	2.09	.97
Moisture	2.50	.17	.19
	100.00	100.00	100.00

Cost, delivered on cars in Cheshire, in lots of ten and twenty tons, $4.67 and $3.67 per ton, and $1.32 per barrel, respectively.

The samples having been sent in paper boxes contained less moisture when received than when put up. The following analyses, published by the Salt Association, show what proportions of of moisture are contained in the fresh article. These figures are probably an average, the refuse being naturally somewhat variable in composition.

	Refuse Salt Washings.	Kiln Refuse.
Chloride of Sodium	50	70
Sulphate of Lime	18	15
Carbonate of Lime and Magnesia	8	5
Insoluble Matter	4	2
Moisture	17	6
Organic Matter	3	2
	100	100

Mr. Smith was desirous of knowing how much potash the sample contained. The amount is too small to be worth considering. The commercial value of these articles is evidently the price put upon them by the manufacturers, there being no competition in this class of goods in our market. The fertilizing value for any given soil or crop is only to be determined by actual trial. On some soils, salt (like gypsum on many soils) produces a good effect, not commonly by directly nourishing crops, for agricultural plants require no soda and very little chlorine, but by its solvent action whereby it disengages plant food from the minerals of the soil, or in some other indirect manner.

STABLE MANURE.

385. New York Stable Manure, sold by H. A. Peck & Co., First Avenue, cor. 38th Street, New York, sampled and sent March 30, by John H. Jennings, Green's Farms, from a cargo purchased by him.

	385	Horse Manure, New York, 1874.	Wolff's average, moderately rotted Stable Manure.
Moisture	69.295	75.76	75.00
Organic Matter*	19.772	19.17	19.20
Potash	.633	.51	.63
Soda	.145	.09	.19
Lime	.742	.30	.70
Magnesia	.288	.19	.18
Oxide of Iron and Alumina	.554	.19	—
Phosphoric Acid	.670	.41	.26
Chlorine	.110	.07	.19
Sulphuric Acid	.156	.09	.16
Sand and Insoluble matter	7.426	3.20	1.68
Carbonic Acid	.209	—	—
Undetermined matters	—	—	1·81
	100.000	100.00	100.00
* With Nitrogen as Ammonia	.118	.26	?
" Nitrogen, total	.693	.53	.50

385 Has nearly the same composition as the sample of New York Stable Manure analyzed in 1874 for the Board of Agriculture; the results published in the Report of the Board for 1873–4, page 350, and here reproduced for the sake of comparison, and also fairly agrees in most respects with Wolff's average of moderately rotted Stable Manure as found in German farming.

385, however, contains about nine per cent. less of moisture and insoluble substances and the proportions of some of the fertilizing matters are correspondingly greater. The cost of this article was six cents per "bushel" of about forty quarts, or one and one-third cubic feet. Mr. Jennings states that several hundred small cargoes of fifty to seventy-five tons each are bought at Green's Farms each year. The cargoes are unloaded on the shore where wanted.

The cost of the horse manure in 1874 at New Haven by rail was $4.00 per ton of forty-nine cubic feet, equal to eight cents per cubic foot, or ten and two-third cents per "bushel" of forty quarts.

VEGETABLE IVORY SAWDUST AND TURNINGS.

403 From the manufactory of E. Smith, Union City, sent by M. S. Baldwin, Secretary Naugatuck Farmers' Club.

This article was sent to the Station with the request to report upon its agricultural value as a fertilizer and cattle food. A similar sample, **69**, from Cheshire, was examined in 1878 in respect to its value as a fertilizer.

The analyses are as follows:

	69	**403**
Moisture		18.78
Organic Matter		80.14
Ash		1.08
		100.00
Nitrogen in Organic Matters	0.48	0.54

As plant food this vegetable ivory has about the same value as straw or dead leaves. It would probably have the same, or a slightly greater value as an ingredient of compost. It is stated to heat and ferment when wet in bulk. Its value in compost, however, requires further observation, since it does not consist mainly of cellulose or woody tissue, but contains sixty-eight per cent. of a carbhydrate soluble in alkalies. See its further analysis under Feeding Stuffs.

SPECIAL FERTILIZERS.

The use of this class of fertilizers would seem to be on the increase. In 1878, twelve samples, in 1879, twelve samples, and this year twenty-four samples have been sent in for analysis. In the first Table of Analyses, p. 47, these fertilizers are arranged in the order in which their cost exceed valuation and the reverse. It is seen from that Table that in the case of fifteen of the samples the cost exceeds the valuation from $1.00 to nearly $25.00, while the valuation of the other nine exceeds the cost from $0.70 to nearly $6.00. It will be noticed that nitrates are the exclusive source of nitrogen in one sample, **469**, and furnish a part of the nitrogen in another, **473.** In a single sample, **423,** all the nitrogen is present as ammonia salts. In three samples, **413, 363,** and **476,** the nitrogen exists entirely in the form of organic matter; in all other cases, the nitrogen is present partly in organic matter and partly as ammonia salts. In seventeen samples the potash exists as muriate, or at least is associated with enough chlorine to form potassium chloride.* In two instances, **425** and **473,** the potash is quite pure sulphate, the samples containing less than one-half per cent. of chlorine. In five samples both sulphate and muriate are present.

In a separate Table, page 48, the composition of these fertilizers as guaranteed, and as found by the Station analyses is given in parallel columns. The results of the analyses are there abbreviated to one place of decimals. In case of phosphoric acid, the guarantee sometimes applies to soluble, sometimes to total, in most cases to "available," which is understood to signify soluble and reverted taken together. In each instance the phosphoric acid in the column "found" corresponds in state or form to that signified in the column "guaranteed." In case of **363** and **476** the guaranteed composition has not been made known to the Station.

Examination of the figures shows that out of the sixty-six comparisons the percentage found falls behind that guaranteed in but five instances, and in but two of these does the deficiency amount to one-half per cent.

The Table on pages 50 and 51 is a comparison of all the analyses of special fertilizers that have been made at the Station, together with a few published by Dr. Goessmann in Massachusetts, and by Prof. Cook, of the New Jersey Experiment Station. In this table

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* i. e., 35.5 of chlorine to 47 of potash.

SPECIAL FERTILIZERS.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Sent by
413	Bowker's Kitchen Garden Fertili'r,	Bowker Fertilizer Co.	S. A. Weldon & Son, Bristol.	S. R. Gridley, Bristol.
417	Stockbridge Root Fertilizer,	" " "	Hubbell & Wakeman, Saugatuck.	James Nash, Saugatuck.
363	" Onion "	" " "	Hubbell & Wakeman.	Dealers.
409	" Root "	" " "	S. A. Weldon & Son.	S. R. Gridley.
476	Matfield Corn "	Matfield " "	C. E. Lord, Chester.	Dealer.
474	Forrester's Grass "	H. J. Baker & Bro.	S. B. Wakeman, Saugatuck.	"
471	" Wheat "	" " "	" " "	"
377	Mapes' Grass and Grain Fertilizer,	Mapes F. & P. G. Co.	A. N. Clark, Milford.	J. M. Nettleton, Milford.
470	Forrester's Fruit Tree "	H. J. Baker & Bro.	S. B. Wakeman.	Dealer.
376	Mapes' Potato "	Mapes F. & P. G. Co.	A. N. Clark, Milford.	J. M. Nettleton, Milford.
435	Stockbridge Tobacco "	Bowker Fertilizer Co.	J. M. Belden, New Britain.	G. M. Barbour, New Britain.
379	Mapes' Corn "	Mapes F. & P. G. Co.	A. N. Clark, Milford.	J. M. Nettleton, Milford.
500	Forrester's Rye "	G. B. Forrester.	S. B. Wakeman.	M. S. Baldwin, Naugatuck.
423	" Cabbage "	H. J. Baker & Bro.	" "	Dealer.
475	" Rye "	" " "	" "	"
407	Stockbridge Corn, "	Bowker Fertilizer Co.	S. A. Weldon & Sons.	S. R. Gridley.
469	Forrester's Lawn Dressing,	H. J. Baker & Bro.	S. B. Wakeman.	Dealer.
425	" Turnip Fertilizer,	" " "	" "	"
426	" Oat "	" " "	" "	"
421	" Corn "	" " "	" "	"
472	" Strawberry"	" " "	" "	"
473	" Tobacco "	" " "	" "	"
420	" Potato "	" " "	" "	"
416	" Onion "	" " "	" "	"

SPECIAL FERTILIZERS.—*Analyses.*

Station No.	Name.	Nitrogen as Ammonia.	Nitrogen as Nitrates.	Organic Nitrogen.	Total Nitrogen.	Soluble Phos. acid.	Reverted Phos. acid.	Insoluble Phos. acid.	Potash.	Chlorine.	Estimated value per ton.	Cost per ton.	Cost exceeds valuation.
413	Bowker K. Garden,	....	....	2.98	2.98	5.12	0.74	0.35	9.82	8.62	$35.38	$60.00*	$24.62
417	Stockbridge Root,	1.40	....	2.40	3.80	4.67	0.53	0.66	7.97	7.03	36.70	50.00	13.30
363	Stockbridge Onion,	....	....	3.10	3.10	4.83	0.51	0.45	7.94	2.63	37.94	50.00	12.06
409	Stockbridge Root,	1.40	....	2.70	4.10	4.70	1.16	0.68	8.08	7.02	39.16	50.00*	10.84
476	Matfield Corn,	....	....	6.06	6.06	1.16	0.88	1.55	5.26	4.98	35.62	45.00	9.38
474	Forrester Grass,	3.07	....	2.37	5.44	2.12	trace	0.95	7.45	7.38	36.63	45.00†	8.37
471	Forrester Wheat,	3.78	....	0.70	4.48	4.57	0.03	1.53	5.63	4.84	39.08	45.00†	5.92
377	Mapes Grass & Grain,	3.03	....	1.71	4.74	2.30	5.19	1.30	6.61	5.20	45.32	51.00	5.68
470	Forrester Fruit Tree,	3.03	....	0.58	3.61	1.39	2.25	0.73	15.05	11.02	38.05	42.50†	4.45
376	Mapes Potato,	0.96	....	2.96	3.92	3.18	5.45	1.77	7.70	5.12	45.64	49.00	3.36
435	Stockbridge Tobacco,	4.62	....	1.49	6.11	5.72	0.37	0.20	5.62	5.16	47.04	50.00*	2.96
379	Mapes Corn,	1.31	....	2.36	3.67	4.08	6.12	1.66	7.21	6.48	45.38	48.00	2.62
500	Forrester Rye,	5.00	....	0.33	5.33	4.73	0.02	1.17	9.45	8.75	45.83	47.50	1.67
423	Forrester Cabbage,	5.62	....	....	5.62	5.74	0.52	0.56	8.16	7.90	48.69	50.00‡	1.31
475	Forrester Rye,	4.53	....	0.82	5.35	4.32	trace	1.21	11.34	10.36	46.37	47.50†	1.13
													Valuation exceeds cost.
407	Stockbridge Corn,	1.58	....	3.13	4.71	5.16	0.84	0.42	6.75	5.93	$40.70	$40.00*	$0 70
469	Forrester Lawn,	....	4.39	....	4.39	4.93	0.80	1.12	12.56	11.21	49.47	47.50†	1.97
425	Forrester Turnip,	6.90	....	1.43	8.33	2.86	0.32	1.09	9.13	0.36	54.01	52.00‡	2.01
426	Forrester Oat,	4.78	....	1.84	6.62	3.40	1.56	0.98	9.18	5.80	49.80	47.50‡	2.30
422	Forrester Corn,	4.67	....	0.19	4.86	5.59	0.47	1.01	14.56	13.52	51.10	47.50‡	3.60
417	Forrester Strawb'ry,	2.43	....	0.50	2.93	4.19	4.69	2.75	8.74	2.08	46.19	42.50†	3.69
473	Forrester Tobacco,	2.05	2.31	1.11	5.47	3.87	trace	0.98	9.69	0.50	51.27	47.50†	3.77
420	Forrester Potato,	4.36	....	0.40	4.76	0.81	4.63	2.09	11.33	3.82	51.50	47.50‡	4.00
416	Forrester Onion,	5.34	....	2.06	7.40	2 56	2.07	1.00	7.25	2.21	54.68	49.00	5.68

* The cost per ton is calculated from the price per bag of 100 or 200 pounds. No prices per ton are given in the circulars of the manufacturers.

† In New York.

‡ In New York. Local price $1.50 higher.

SPECIAL FERTILIZERS.

Station No.	Nitrogen.		Phosphoric Acid.		Potash.	
	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed	Found.
Bowker—						
413	2.9—3.7	3.0	5—6*	5.1	6—7	9.8
Stockbridge—						
363						
407	4.1—4.9	4.7	5—6*	5.2	5.5—6.5	6.8
409	3.3—4.1	4.1	6—7	5.9	7—8.5	8.1
417	3.3—4.1	3.8	6—7	5.2	7—8.5	8.0
435	5 —6	6.1	4—5*	5.7	5—6	5.6
Matfield—						
476		6.1		2.0		5.3
Mapes—						
376	3.7—4.1	3.9	8—10†	10.4	6—8	7.7
377	4.1—5.8	4.7	9— 8†	8.8	5—7	6.6
379	3.7—4.1	3.7	10—12†	11.9	6—7	7.2
Forrester—						
416	5.8	7.4	3.5	4.6	7	7.3
420	3.5	4.8	5.5	5.4	10	11.3
421	5.1	4.8	5.5	6.1	9	14.6
423	4.3	5.6	5	6.3	7	8.2
425	6.8	8.3	3	3.2	8.3	9.1
426	5.4	6.6	4	5.0	8	9.2
469	2.7	4.4	5	5.7	5	12.6
470	1.6	3.6	3	3.6	10	15.1
471	5.1	4.5	4	4.6	4	5.6
472	2.5	2.9	5	8.9	6	8.7
473	4.1	4.4	1	3.9	8.3	9.7
474	4.9	5.4	2	2.1	6	7.5
475	4.9	5.4	4	4.3	8	11.3
500	4.9	5.3	4	4.8	8	9.5

* Soluble. † Total.

the fertilizers are arranged according to the crops for which they are intended, and by the name with which they are commonly designated. The table serves to show (1) the variations which the same brand has been subject to from year to year, and (2) the often wide variations between different brands made for the same crop. Since the manufacturers give abundant testimonials from practical farmers, showing that each of these fertilizers is well-adapted for its purpose, we can hardly avoid concluding that it makes very little difference to the corn crop, for example, whether a corn fertilizer contains 6.2 or 3.7 per cent. of nitrogen, 11.4 or 2 per cent of available phosphoric acid, 14.6 or 4.6 per cent. of potash !

When we consider that soils differ very widely from each other in native producing power, and may be made to differ as widely by the treatment they receive under what we term "cultivation," there can be no doubt that any one of these special fertilizers may be used as profitably on any other crop as on that after which it is named.

Cost of Active Ingredients of Fertilizers during 1880.

Organic Nitrogen has cost in the manipulated fertilizers, viz: superphosphates and special manures, on the average, more than the amount allowed in the valuations, *i. e.* twenty cents per pound. In dry fish scrap the cost has been eighteen cents. In the samples of low-grade dried blood and tankings analyzed by the Station, nitrogen has cost sixteen cents and in castor pomace and cotton seed meal it has also cost sixteen cents. The nitrogen of fine bone has been bought for fifteen cents. The ruling market price of nitrogen in the highest grades of dried blood, has been during the spring, until mid-summer, about fifteen cents. In the autumn, as usual, the price advanced because of active demand among the manufacturers of superphosphates, etc., and reached eighteen cents per pound.

It is plain that there is a considerable and permanent difference between the trade-value or cost to the farmer, of organic nitrogen in the superphosphates and other manipulated fertilizers and that of the raw materials ordinarily accessible to the retail purchaser. To adapt our system of valuation more perfectly to this state of things, I shall continue to rate organic nitrogen in superphosphates and special manures and in fine steamed bone, finely ground and dry meat, blood and fish, and in Peruvian guano, at twenty cents. In view of the market prices that have ruled for two years, I shall rate together the nitrogen of coarse or moist meat, blood, tankage, castor pomace and cotton seed meal at sixteen cents. The trade-values of nitrogen in the various grades of bone will also be reduced to conform to their actual cost. See statement and Table on page 31.

Nitrogen in the form of Ammonia-Salts and Nitrates.—Ammonia salts do not appear in our retail market except as ingredients of some manipulated fertilizers, and the Station valuation for their nitrogen will remain as formerly. Nitrates in the single sample of nitrate of soda analyzed, has furnished nitrogen

COMPARISON OF SPECIAL MANURES.

According to their Brands and the Crops for which they are offered.

(See paragraph at bottom of pp. 45 and 48.)

Station No.	Name.	Year.	Nitrogen.	Phos. acid sol. and rev.	Potash.	Crop.
137	Stockbridge.	1878	5.9	5.4	6.6	Corn.
195	"	'78	6.2	3.8	7.0	
407	"	'80	4.7	6.0	6.8	
N. J.	"	'80	4.8	7.2	6.2	
476	Matfield.	'80	6.1	2.0	5.3	
379	Mapes.	'80	3.7	10.2	7.2	
N. J.	"	'80	4.0	11.4	4.6	
N. J.	"	'80	3.9	6.5	7.7	
300	Forrester.	'79	5.5	5.3	13.1	
421	"	'80	4.8	6.0	14.6	
	highest	per cent.	6.2	11.4	14.6	
	lowest	"	3.7	2.0	4.6	
146	Stockbridge.	'78	3.5	6.4	10.2	Potato.
260	"	'79	3.8	7.0	8.8	
409	"	'80	4.1	5.9	8.1	
417	"	'80	3.8	5.2	8.0	
Mass.	"	'79	4.4	3.8	7.6	
116	Forrester.	'78	5.7	7.6	11.4	
282	"	'79	4.6	5.5	9.1	
304	"	'79	4.8	5.3	10.3	
420	"	'80	4.8	5.4	11.3	
128	Mapes.	'78	3.7	4.5	14.8	
376	"	'80	3.9	8.6	7.7	
	highest	per cent.	5.7	8.6	14.8	
	lowest	"	3.5	3.8	7.6	
258	Stockbridge.	'79	3.9	6.4	8.3	Onion.
363	"	'80	3.1	5.3	7.9	
259	Mapes.	'79	5.7	6.2	7.5	
301	Forrester.	'79	7.4	4.5	7.4	
416	"	'80	7.4	4.6	7.3	
	highest	per cent.	7.4	6.4	8.3	
	lowest	"	3.1	4.6	7.3	

Station No.	Name.	Year.	Nitrogen.	Phos. acid. sol. and rev.	Potash.	Crop.
274	Stockbridge.	'79	5.7	1.4	7.4	Tobacco.
435	"	'80	6.1	6.1	5.6	
Mass.	"	'79	6.7	1.9	9.4	
473	Forrester.	'80	5.5	3.9	9.7	
	highest	per cent.	6.7	6.1	9.7	
	lowest	"	5.5	1.9	5.6	
175	Stockbridge	'78	4.4	7.8	6.5	Strawberry.
284	Forrester.	'79	3.0	10.3	5.9	
472	"	'80	2.9	8.9	8.7	
	highest	per cent.	4.4	10.3	8.7	
	lowest	"	2.9	7.8	5.9	
471	Forrester.	'80	4.5	4.6	5.6	Wheat.
475	"	'80	5.4	4.3	11.3	Rye.
500	"	'80	5.3	4.8	9.5	Rye.
426	"	'80	6.6	5.0	9.2	Oat.
Mass.	Stockbridge.	'79	5.4	4.6	6.2	Oat.
	highest	per cent.	6.6	5.0	11.3	
	lowest	"	4.5	4.3	5.6	
144	Mapes.	'78	4.3	6.0	3.7	Grass & grain top dr.
377	"	'80	4.7	7.5	6.6	" " "
197	Stockbridge.	'78	8.7	2.1	10.4	Grass top dr.
280	"	'79	6.1	4.1	7.5	" "
201	Forrester.	'78	5.7	4.1	12.1	Grass.
474	"	'80	5.4	2.1	7.5	"
469	"	'80	4.4	5.7	12.6	Lawn Dressing.
181	Bowker.	'78	8.0	5.2	6.4	" "
	highest	per cent.	8.7	7.5	12.6	
	lowest	"	4.3	2.1	3.7	
193	Stockbridge	'78	4.6	5.6	7.2	Kitchen Garden.
196	"	'78	5.1	4.1	7.7	Squashes.
413	Bowker.	'80	3.0	5.9	9.8	Kitchen Garden.
281	Forrester.	'79	6.3	6.1	7.4	Cabbage.
423	"	'80	5.6	6.3	8.2	"
	highest	per cent.	6.3	6.3	9.8	
	lowest	"	3.0	4.1	7.2	

at twenty-eight cents, but since probably the price will fluctuate, no change in its trade-value appears to be called for.

Soluble Phosphoric acid has been procurable in 1880 as in 1879, at a cost of ten cents per pound in the imported superphosphate **436**, see p. 23. In our home-made manipulated fertilizers it still costs twelve and one-half cents, and that may therefore remain as the Station valuation.

Reverted Phosphoric acid in the various manipulated fertilizers has cost no less than formerly, and the former price, nine cents, is retained.

Insoluble Phosphoric acid in dry fish and in the different grades of bone, has cost one cent per pound less than last year's valuation. See Table, p. 31.

Potash, in nearly pure, high grade sulphate, is reckoned at seven cents, and in muriate, at three and one-half cents per pound. p. 39. In low grade sulphates containing magnesium chloride, and in kainite, it would probably be fair to reckon potash at five and one-half cents. For comparison of the trade-values employed in 1880 with those it is proposed to use in 1881, see pp. 19 and 21.

SWAMP MUCK AND PEAT.

Fifteen samples of this material have been subjected to analysis.

446 Swamp Muck No. 1. Upper stratum.
447 Swamp Muck No. 1. Lower stratum.
448 Swamp Muck No. 2.
} From farm of Messrs. John and Andrew Jackson, Wilton. Sent by D. H. Van Hoosear, Secrotary Farmers' Club, East Wilton.

449 Cured Muck.
450 Fresh Muck.
} Sent by S. B. Wakeman, Saugatuck.

451 Muck. Sent by G. W. Stanley, New Britain.

452 Fibrous Muck, from above 453.
453 Bottom Muck, from below 452.
} Sent by Henry Hine, Oxford.

454 Mucky soil of drained meadow, from Augustus Storrs, Mansfield.

465 Swamp Muck, from Ed. C. Birge, Southport.

467 A, Swamp Muck. Upper layer.
467 B, Swamp Muck. Lower layer.
} From Lewis Davis, Milford.

492 Muck, from W. E. Simonds. Canterbury.

510
511
} Muck from H. A. Slater, North Manchester.

Samples **446**, **447** and **448** are from a swamp of ten acres, owned by Messrs. John and Andrew Jackson of Wilton. **446** and **447** are from the head of the swale, the former from the surface, the latter from a lower stratum. **448** was taken from the same swale one-half mile distant and at a lower level. Muck from both localities has been used for many years as an absorbent, and also has been applied in spring direct to crops after having been dug in fall and exposed to air and frost during winter. **446** and **447** have given very good results. **448** has been less valuable.

The analyses show large differences of composition, in the fresh samples. We observe, first, that **446** is a very pure muck and quite fully saturated with (eighty per cent.) of water. **448** is drier and contains forty-five per cent. of soil and mineral matter, while **447** stands intermediate. If the three were applied in corresponding states of dryness, we can see that in the first two we should have much more organic matters, with more nitrogen, and likewise more lime than in the last. This appears from the figures in the table, showing the composition of the dry, water-free mucks, p. 54.

The *per cent.* of nitrogen, and that of lime in the dry samples may be taken as fair measures of their relative value. **446** ranks accordingly among the best, while **448** is nearly the poorest of the samples here reported.

The inferiority of **448** is evidently largely due to the fact that nearly three-fourths of it is sand or soil. Reference to the last line of figures in the table shows that the organic matter which it contains is as rich in nitrogen as that of **446.** We see, in fact, that in both these and in seven of the other samples the organic matters contain about two and one-half per cent. of nitrogen.

449 and **450,** from S. B. Wakeman, of Saugatuck, are, it is understood, two samples from the same bed, the former dug a year ago or more and exposed during the winter, the latter a freshly excavated sample. The cured muck, **449,** is used as an absorbent and for composting. The questions asked by Mr. Wakeman are:—

1. "Is the cured muck worth carting 100 rods to use as absorbent and in compost?" and,

2. "Has the muck any value in its fresh state?"

The differences in composition which appear in the undried samples are almost entirely due to their unlike proportions of water, viz: 38 and 85½ per cent. Dry, they agree in containing about 90 per cent. of organic matter with 2.2 per cent. of nitrogen, and about 10 per cent. of ash with 2 per cent. of lime.

To Mr. Wakeman's questions the following answers were given:

1. **449** is well worth carting 100 rods to use as an absorbent. It contains as analyzed, with thirty-eight per cent. water, nearly twice as much nitrogen as good stable manure, and of this there

ANALYSES OF SWAMP MUCK.

The fresh or undried samples contain per cent.:

	446	447	448	449	450	451	452	453	454	465	467A	467B	492	510	511
Water,	80.68	62.25	42.19	38.04	88.51	32.08	77.23	70.90	67.26	73.81	87.13	81.36	79.73	50.47	42.34
Organic (vegetable) and volatile matter,	15.93	26.33	12.80	55.72	10.40	53.82	21.83	7.55	19.75	23.39	11.55	6.94	16.74	18.96	41.49
Ash, including sand and soil,	3.39	11.42	45.01	6.24	1.09	14.10	0.94	21.55	12.99	2.80	1.32	11.70	3.53	30.57	16.17
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
THE ASH CONTAINS,															
Silica and substances insoluble in acid,	2.19	7.66	36.08	3.34	0.42	9.83	0.42	....	7.87	1.63	0.48	10.78	2.63	27.36	13.36
Oxide of iron, alumina and phos. acid,	0.35	0.88	6.32	0.70	0.13	....	0.31	1.61	4.55	0.34	0.20	0.57	0.27	1.73	1.70
Lime,	0.44	1.78	0.69	1.32	0.23	1.28	0.09	0.06	0.11	0.38	0.35	0.09	0.42	0.78	0.10
Other matters not separately determ'd,	0.41	1.10	1.92	0.88	0.31	2.99	0.12	....	0.46	0.45	0.29	0.26	0.21	0.70	1.01
Nitrogen (in organic matter),	0.41	0.33	0.33	1.36	0.25	0.91	0.24	0.26	0.41	0.60	0.31	0.18	0.44	0.56	0.74
Poisonous iron-salts: soluble in water,	none	none	none	none	none	none	none	trace	much	none	none	none	none	none	none
The dry (water free) mucks contain per cent.:															
Organic and volatile matters,	82.44	69.48	22.14	89.93	90.51	79.24	95.87	25.95	60.32	89.31	89.74	37.23	82.58	38.28	71.95
Ash,	17.56	30.52	77.86	10.07	9.49	20.76	4.13	74.05	39.68	10.69	10.26	62.77	17.41	61.72	28.05
Lime,	2.27	4.71	1.19	2.13	2.00	1.88	0.39	0.26	0.33	1.45	2.72	0.48	2.07	1.57	0.17
Nitrogen,	2.12	0.87	0.57	2.19	2.18	1.34	1.05	0.89	1.25	2.29	2.40	0.96	2.17	1.13	1.28
The organic matter of the mucks contains per cent.:															
Nitrogen,	2.57	1.25	2.58	2.44	2.40	1.69	1.10	3.44	2.08	2.57	2.68	2.59	2.63	2.95	1.78

can be no reasonable doubt that a good portion would become available to crops, especially after composting with dung and urine. It also contains four times as much lime as stable manure.

2. As to the value of **450,** the fresh dug muck, it would doubtless be serviceable if well pulverized and distributed upon sandy, droughty soil. It contains nothing injurious to vegetation.

The chief advantages of "curing" muck by exposure to air and frost are, 1, pulverization, 2, removal of a share of the useless water, and 3, removal of the soluble poisonous salts of iron. The sample **450,** like all but two of those here reported, is free from injurious iron-salts, and except for the cost of carting its extra water and the convenience of application, it might, most probably, be applied as well fresh as cured.

451, from G. W. Stanley, of New Britain, was a well cured or dried sample, but still retained thirty-two per cent. of water. The composition in the dry state shows it to be rather above medium quality, with 1.9 per cent. lime and 1.3 per cent. nitrogen. Its content of sand and soil (fifteen per cent. or more of the dry muck) depresses the nitrogen, but the organic matter itself contains a less proportion of this element than that of any other sample except **452.**

452 and **453,** from Henry Hine, of Oxford, represent respectively the upper and lower layers of the same bed. **452** was coarse and fibrous from undecayed vegetation. The organic matter of **453** was more fully decomposed but was admixed with clay and fine soil, to the extent of seventy-four per cent. These are the poorest mucks here reported, averaging when water-free but one-third per cent. of lime and one per cent. of nitrogen. The bottom sample contains some soluble and poisonous iron-salts which would disappear by thorough weathering, or more speedily and certainly by composting with ashes, potash or lime. Such muck would probably not pay to apply fresh, except on light, leachy land, and there would be of advantage mainly as an amendment of too great porosity and droughtiness and not as a fertilizer.

454, from the farm of Augustus Storrs, Mansfield, is an interesting sample, as it represents a piece of meadow land that has been drained and cultivated for three or four years, but, as Mr. Storrs reports, all attempts to get crops of buckwheat, corn or turnips have totally failed—even weeds do not grow upon it. The surface of the ground when it dries becomes white as if salt or plaster had been sown upon it.

The barrenness of this soil is due to iron-salts soluble in water, mainly proto-sulphate of iron, the same thing as copperas or green-vitriol, which is present in considerable proportion and which poisons and destroys all vegetation. The remedy is a copious application of leached ashes or lime. Unless there is permanent bottom water also poisoned by iron-salts, the lime will shortly cure the difficulty. The sample is more of a muck than a soil, containing sixty per cent. of vegetable and volatile matters, and not only has excess of iron-salts but is deficient in lime and presumably in other mineral plant food, so that leached ashes would be the most suitable application.

465. This muck, from E. C. Birge, Southport, is seen, from the statement of its composition in the water-free state, to contain nearly ninety per cent. of vegetable matter with 2.3 per cent. of nitrogen, and 1.5 per cent. of lime; it is accordingly of excellent quality. Mr. Birge states that it can be delivered on the adjacent upland at eighteen cents per cart load of twenty-five bushels. Mr. Birge asks:

1. After letting it dry on the upland, will it pay to cart to the yard one-half or three-fourths mile distant for litter?
2. Will it pay to top-dress pastures near the swamp with raw muck?
3. Will it pay to compost with lime at the swamp?

Queries 1 and 3 were answered in the affirmative. In reply to the second question, a doubt as to the advantage of its direct use was expressed. Evidently, however, nothing but actual experience can positively decide these questions, and the answers given, being offered without a careful examination of all the circumstances of the case, are merely opinions that are intended to be safe, but are not expected to be exact.

467A and **467** B, from Lewis Davis, Milford, are respectively the black upper and brown lower layers of the same deposit. Mr. Davis asked which is the best, and if either or both are worth applying to sandy loam directly or after composting with something besides yard manure.

The analysis indicates the muck to be of the best quality. The lower portion is, however, largely mixed with soil. This renders it less rich in nitrogen and lime, and therefore inferior as a fertilizer; but as the soil it contains is mostly of very fine pulverization, it is not less valuable as an amendment on light, open-textured soils. The best materials next to stable manure to compost with would be unleached wood ashes, or fresh burned and slacked lime. By slacking the cheapest oyster-shell lime, mixed with say one-tenth as much kainite (potash salts) or low grade sulphate of potash, and composting with the muck, the latter will not only yield its nitrogen rapidly, but its lack of potash, magnesia, etc., will be supplied. To one cord or one hundred bushels of muck, ten bushels of lime may be used.

492, From W. E. Simonds, Canterbury, is also a muck of high quality, judged from the analysis, the dry substance containing over two per cent. each of lime and nitrogen.

510, Sent by H. A. Slater, North Manchester, taken from a ditch at the edge of a swamp of three or four acres which has had some wash from adjacent hillsides, and which yields a light growth of coarse hay. The sample was from a pile dug in the fall of 1879, and hauled in October, 1880, to a barn to be used as an absorbent.

511 is from a depression of three to four acres on high ground, where the wash is less than in the case of **510.** Vegetation is mainly moss with isolated bunches of grass and birch trees. The sample is from a heap that has been dug two years.

510 and **511** are both mixed with a good deal of soil, but still contain more than the average of nitrogen. The 1.57 per cent. of lime in **510** water-free, stands doubtless in connection with the fact that it carries a growth of coarse grass, while the smaller amount (.17 per cent.) in **511** partly explains the absence of grass and prevalence of moss on the swamp from whence it was taken.

In the same stage of dryness **510** is much the richer of the two, notwithstanding it contains more than twice as much soil as **511.**

For full details as to methods of handling and composting, the reader is referred to my Report on Peat and Muck, published in the Transactions of the Connecticut State Agricultural Society for the year 1858, and afterward revised and enlarged and issued by Orange Judd & Co., under the title, "Peat and its Uses as Fertilizer and Fuel."

EXPERIMENTS ON THE EFFECTS OF ALKALIES IN DEVELOPING THE FERTILIZING POWER OF PEAT.

During the summer of 1862, the writer undertook a series of experiments with a view of ascertaining the effect of various composting materials upon peat.

An account of these experiments was published in "Peat and its Uses," and I copy that account here, for two reasons: 1. To show the very positive effect of alkalies in rendering the nitrogen of peat available to vegetation.

2. To illustrate the benefit of pot-experiments when properly made.

The Station ought to carry on such experiments constantly, and is only hindered from doing so by the want of any suitable place for prosecuting them.

Experiments.

Two bushels of peat were obtained from a heap that had been weathering for some time on the "Beaver Meadow," near New Haven. This was thoroughly air-dried, then crushed by the hand, and finally rubbed through a moderately fine sieve. In this way, the peat was brought to a perfectly homogeneous condition.

Twelve one-quart flower-pots, new from the warehouse, were filled as described below; the trials being made in duplicate:

Pots 1 and 2 contained each 270 grams* of peat.

Pots 3 and 4 contained each 270 grams of peat, mixed with 10 grams of ashes of young grass.

Pots 5 and 6 contained each 270 grams of peat, 10 grams of ashes, and 10 grams of carbonate of lime.

Pots 7 and 8 contained each 270 grams of peat, 10 grams of ashes, and 10 grams of slaked (hydrate of) lime.

Pots 9 and 10 contained each 270 grams of peat, 10 grams of ashes, and 5 grams of lime, slaked with strong solution of common salt.

Pots 11 and 12 contained each 270 grams of peat, 10 grams of ashes, and 3 grams of Peruvian guano.

In each case the materials were thoroughly mixed together, and so much water was cautiously added as served to wet them thoroughly. Five kernels of dwarf (pop) corn were planted in each pot, the weight of each planting being carefully ascertained.

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* 1 gram = 14¼ grains. 1 oz. = 28⅓ grams.

The pots were disposed in a glazed case within a cold grapery,* and were watered when needful with pure water. The seeds sprouted duly, and developed into healthy plants. The plants served thus as tests of the chemical effect of carbonate of lime, of slaked lime, and of salt and lime mixture on the peat.

The plants were allowed to grow until those best developed, enlarged above, not at the expense of the peat, etc., but of their own lower leaves, as shown by the withering of the latter. They were then cut, and, after drying in the air, were weighed, with the subjoined results.

Nos.	Medium of growth.	Weight of crops in grams.		Comparative weight of crops, the sum of 1 and 2 being taken as unity.	Ratio of weight of crops to weight of seeds, the latter assumed as unity.
1 2	Peat alone.	1.61 2.59	4.20	1	2½
3 4	Peat, and ashes of grass.	14.19 18.25	32.44	8	20½
5 6	Peat, ashes and carbonate of lime.	18.19 20.25	38.44	9	25½
7 8	Peat, ashes and slaked lime.	21.49 20.73	42.22	10	28½
9 10	Peat, ashes, slaked lime and salt.	23.08 23.34	46.42	11	30½
11 12	Peat, ashes and Peruvian Guano.	26.79 26.99	53.78	13	35½

Let us now examine the above results. The experiments 1 and 2 demonstrate that the peat itself is deficient in something needful to the plant. In both pots, but 4.2 grams of crop were produced, a quantity two and a half times greater than that of the seeds, which weighed 1.59 grams. The plants were pale in color, slender, and reached a height of but about six inches.

Nos. 3 and 4 make evident what are some of the deficiencies of the peat. A supply of mineral matters, such as are contained in all plants, being made by the addition of ashes, consisting chiefly of phosphates, carbonates, and sulphates of lime, magnesia, and potash, a crop is realized nearly eight times greater than in the previous cases; the yield being 32.44 grams, or 20½ times the weight of the seed. The quantity of ashes added, viz: 10 grams, was capable of supplying every mineral element, greatly in excess of the wants of any crop that could be grown in a quart of soil. The plants in pots 3 and 4 were much stouter than those in 1 and 2, and had a healthy color.

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* To the kindness of Joseph E. Sheffield, Esq., of New Haven, the writer is indebted for the use of the glass house for setting up these experiments. The young vines did not seriously obstruct the sunlight.

The experiments 5 and 6 appear to demonstrate that carbonate of lime considerably aided in converting the peat itself into plant-food. The ashes alone contained enough carbonate of lime to supply the wants of the plant in respect to that substance. More carbonate of lime could only operate by acting on the organic matters of the peat. The amount of the crop is raised by the effect of carbonate of lime from 32.44 to 38.44 grams, or from 20½ to 25½ times that of the seed.

Experiments 7 and 8 show, that slacked lime has more effect than the carbonate, as we should anticipate. Its influence does not, however, exceed that of the carbonate very greatly, the yield rising from 38.44 to 42.22 grams, or from 25½ to 28½ times the weight of the seed. In fact, quicklime can only act as such for a very short space of time, since it rapidly combines with carbonic acid, which is supplied abundantly by the peat.

In experiments 7 and 8, a good share of the influence exerted must therefore be actually ascribed to the carbonate, rather than to the quicklime itself.

In experiments 9 and 10, we have proof that the "lime and salt mixture" has a greater efficacy than lime alone, the crop being increased thereby from 42.22 to 46.42 grams, or from 28½ to 30½ times that of the seed.

Finally, we see from experiments 11 and 12 that in all the foregoing cases it was a limited supply of nitrogen that limited the crop; for, on adding Peruvian guano, which could only act by this element (its other ingredients, phosphates of lime and potash, being abundantly supplied in the ashes), the yield was carried up to 53.78 grams, or 35½ times the weight of the seed, and 13 times the weight of the crop obtained from the unmixed peat.

INFLUENCE OF LIME ON THE EFFECT OF FERTILIZERS.

Relative Fertilizing Value of Soluble and Reverted Phosphoric Acid.—In March last, Mr. S. B. Wakeman, of Saugatuck, inquired of the Station, "if caustic lime be put on the ground and superphosphate of lime also applied, what action has the lime on the soluble phosphoric acid?"

Mr. T. B. Wakeman, of Green's Farms, wishing to manure three acres of onion ground heavily with stable manure, blood guano and superphosphate, and also to apply eight barrels of slacked lime and 1500 pounds of salt, for the purpose of destroying worms, likewise inquired whether the lime would injure the effect of the superphosphate.

These inquiries touch several important points, viz: the effect of caustic lime on the nitrogen and phosphoric acid of fertilizers, and consequently the relative value for fertilizing purposes of the various forms or states of phosphoric acid. Before reproducing here the brief answers given to the above inquiries, a short discussion of these points is offered.

If we mix lime intimately with manures containing ammonia-salts, the ammonia is set free as a gas and escapes into the air.

Again, if we mix lime with a fertilizer containing phosphoric acid, or phosphates soluble in water, there is formed so-called reverted phosphoric acid, i. e., phosphate of lime insoluble in water.

From these facts it has been inferred that lime should not be mixed with fertilizers containing either ammonia-salts or soluble phosphoric acid. This is, in fact, generally speaking, sound doctrine as applied to mixing fertilizers with lime before application. It should be remembered, however, that few fertilizers contain much ammonia-salts. Stable manure contains but three or four pounds of ammonia to the ton, and the ordinary superphosphates and special manures rarely contain more than two or three per cent. of ready-formed ammonia. On mixing with lime, enough ammonia might be liberated to affect the sense of smell, more or less powerfully, but the loss thus occasioned would be in most cases comparatively trifling, and far smaller than might be inferred from the odor, because the nose is a very sensitive test for ammonia, and because the intermixture and contact of the lime and the manure would be extremely rough and incomplete, and therefore such a mass might be left for days, giving off the smell of ammonia all the time, and then have lost but a fraction of that originally present. It has also been taught that it is a wasteful or injurious practice to apply lime to *the land* at or near the time of dressing it with stable manure, guano and superphosphates. This teaching is not always or altogether correct.

The mixing together, in the soil, of lime and fertilizers containing ammonia-salts, can scarcely occasion much loss, because the soil, by its moisture, by its humus, i. e., vegetable matter in decay, and by the absorbent silicates, which are never absent from earth that has any moderate productive power, is ready to take up at once the liberated ammonia, and prevent any sensible waste.

The very slight escape of ammonia that would result from applying together lime and manure containing ready-formed ammonia may, therefore, oftentimes be more than compensated by the farmer's convenience, or by other actual or prospective advantages. To mix together lime and a soluble phosphate, (one containing soluble phosphoric acid), at first sight would appear to be a grievous error, because the soluble phosphate is obtained by acting on an insoluble phosphate with oil of vitriol, at such an expense that one pound of soluble phosphoric acid costs as much as three or four pounds of insoluble.

To mix the soluble phosphate with lime is said to undo what was done by the oil of vitriol, and this is true in a sense, and to a degree. But the original insoluble phosphate, whether South Carolina rock phosphate, Canadian apatite, bone black, or whatever else, is a very different thing from the precipitated phosphate which results from the action of lime on soluble phosphoric acid. The former is coarse, dense and very insoluble, and under ordinary circumstances without immediate sensible effect on crops. The latter is an efficient fertilizer, quite similar in nature or at least in effects, to the phosphates of the fertile soil, being excessively fine in its division and no doubt readily taken up by the roots of plants. On the other hand, soluble phosphoric acid in some circumstances may act detrimentally, so that in such circumstances a superphosphate, mixed with lime at or previous to application, would do better than when applied without lime.

It was long ago remarked in agricultural practice in France, that certain low-grade native phosphates, which could not be economically made into superphosphates, gave little immediate or perceptible benefit when applied finely ground to various loamy or sandy lands, but on *certain other soils, rich in humus*, operated promptly and strikingly. This fact indicates that insoluble phosphates are made soluble and available to vegetation by the various acids resulting from vegetable decay. Quite in harmony with this is the experience of Dr. Ravenel, of Charleston, S. C., who has found that finely-ground Charleston phosphate rock is quite assimilable by vegetation, when applied in conjunction with vegetable matter, obtained by plowing under a large growth of the Southern pea, or letting it decay on the surface of sandy and otherwise nearly worthless land. In fact, the decaying vegetation would appear to dissolve the phosphate as effectually and more economically than sulphuric acid. That is to say, a better economical result is obtained, by applying a dollar's worth of fine ground phosphate rock with a decaying green crop, than by using the same worth of artificially dissolved phosphate, the latter containing about one-third or one-fourth as much phosphoric acid as the former.

Various experimenters have, in fact, found that humus dissolves the insoluble crude phosphates. Quite recently M. Beletzky has observed that a mineral phosphate (phosphorite) containing fifteen per cent. of phosphoric acid, put in contact with five times as much peat, (swamp muck), in presence of water, yielded in five days one-eighth of its phosphoric acid in solution to the liquid.

Hon. S. L. Goodale, for many years secretary to the Board of Agriculture of the State of Maine, states that some farmers of his acquaintance prefer the "Cumberland Phosphate," made at Portland, I believe, after it has, by keeping, suffered the "reversion" of nearly all its soluble phosphoric acid.

Various pot and field experiments, recently made in Germany and Belgium, have shown in some cases an equally good or even better effect from reverted than from soluble phosphoric acid. On a "sterile lime sand," Dr. Wein, of Munich, found that reverted phosphoric acid gave considerably better results than soluble phosphoric acid, or than soluble superphosphate of lime. It would thus appear that in some cases it may be no disadvantage to apply lime and superphosphate together; in other cases it may be a positive advantage. On the other hand, in many instances, the superiority of soluble over reverted and insoluble phosphates would seem to have been fully demonstrated, not only for sandy, loamy and clayey soils, but also for those rich in humus. In seventeen field trials, recently reported from the Experiment Station at Kiel, in Holstein, the result is that on the loamy soils, in general, a pound of reverted phosphoric acid gave about half the effect obtained from the same amount of soluble. On sandy soils, adjacent to moorland and rich in humus, the soluble operated decidedly better than the reverted. On newly reclaimed moorland, the reverted gave better results than the soluble, but on moorland that had been limed, the soluble gave the better results.

Exceptions to the most general rule were not wanting. In one case reduced phosphate surpassed soluble on a loam. Fleischer, near Bremen, found in a series of nine comparative trials on five moor soils, that the soluble phosphate surpassed the reverted, strikingly in one case, was strikingly surpassed in one case, while in seven instances both operated about equally well.

From a careful review of the facts now on record bearing on this question, it is plain that we have not the means of deciding with certainty when and why one or the other forms of phosphoric acid is best. The recently published experiments are more suggestive than conclusive. The subject has been engaging attention at the German Stations, and doubtless we shall soon obtain positive information on these points.

So far as can be concluded from the data at hand, it is probable that soluble phosphoric acid is uneconomical on soils containing superabundant humus, because such soils already have a surplus of acid. In them not only do carbonic acid and the peculiar acids of humus abound, but even acetic acid (the acid of vinegar) and similar equally energetic acids, are likely to be formed under a favorable temperature.

It has been demonstrated that agricultural plants are injured or destroyed by either a slight amount of free acid or free alkali in contact with their roots. Therefore, when the soil is itself acid, any added acid, (and soluble phosphates are usually acid), increases an already present or impending evil.

Soils rich in humus do not, however, necessarily have a surplus of acid. They may contain originally or may have added to them carbonate of lime in such quantity that the development of free acid is rendered impossible. In fact, such soils may become alkaline in hot, moist weather from the development of ammonia. The circumstances in which lime may act detrimentally on a superphosphate, are probably when the lime is present in relatively large quantity, and the soil is at the same time deficient in organic matter.

To Mr. S. B. Wakeman's inquiry, was answered substantially as follows: When *soluble phosphoric acid* is put in the soil, it gradually passes into the state of *reverted phosphoric acid*, by the action of the lime and iron of the soil. If caustic lime be applied to the land, the process is simply hastened. Whether or not this effect of the caustic lime is a disadvantage or an advantage, appears to depend on circumstances. In mucky soil or soil containing a good deal of vegetable matter, reverted phosphoric acid oftens works as well, or even much better, than soluble phosphoric acid. In fact, soluble phosphoric acid should be cautiously applied on such land. On soil where bone does little good—dry, sandy loam with little vegetable matter—soluble phosphoric acid usually operates well, better than reverted. The inference is that lime would work well with superphosphate on soil containing abundant humus, but had better not be applied at the same time with soluble phosphoric acid on dry lands deficient in vegetable matters. Lime is best applied on grass; superphosphate on grain or hoed crops. I don't suppose, however, that on land in good condition it would ordinarily make a difference worth considering, whether the two be used together or separately, but in some cases the lime operates against the superphosphate.

To Mr. T. B. Wakeman was answered: It is not probable that a moderate application of salt and lime will damage the manure and phosphate on your onion land to a degree worth mentioning. If they could be put on some time apart, it would perhaps be better, but even if applied at the same time and at once worked in, no serious loss or detriment could occur on well-manured loamy land, suitable for onions.

Mr. T. B. Wakeman writes, Dec. 9, 1880, that the use of lime and salt has been, this season, quite effectual in staying the ravages of the worms, which otherwise have made serious havoc with the onion crop. He states, further, that in his opinion the caustic lime has not interfered with the action of the manures, and says that next Spring, lime and salt will be considerably used, both on onion and strawberry land, for the purpose of destroying worms.

Where it is intended to apply potash-salts as a fertilizer, it would be an advantage to use muriate of potash, instead of salt (muriate of soda) in slacking the lime. Muriate of potash would doubtless have, in connection with lime, substantially the same effect in destroying worms that salt exerts, and would be afterwards much more serviceable to the crop than common salt can be, because considerable quantities of potash are indispensable to all plants, while soda is either not necessary to their growth, or is required in only very small amount.

Leather Chips.

The Station has had several inquiries as to the value of Leather Chips for fertilizing purposes. Leather chips contain usually 5 to 8 per cent. of nitrogen, but this nitrogen is totally unavailable to vegetation unless the leather is brought into a state of decay or is acted upon by some powerful chemical agent. Leather is, however, specially prepared to resist decay, and hence chips of it, when brought into the soil, are very slow to benefit vegetation. The activity of leather is hastened by fine division, but there has been devised no ready and cheap means of pulverizing so tough a substance. It may indeed be rendered brittle by roasting at a moderate heat and then may be easily ground to powder. Prof. F. H. Storer has made a series of valuable pot-experiments for the purpose of testing the effects of raw and roasted leather on vegetation. These investigations, published in the Bulletin of the Bussey Institution, vol. II, pp. 58–71, 1877, have demonstrated that raw sheep-skin and sole-leather are totally incapable of feeding plants, are in fact rather detrimental to vegetation. The experiments likewise prove that roasted leather, while it shows some slight nourishing value, is still comparatively so inert that it can scarcely have any definite money value as a manure. It is in fact no better fertilizer in respect to nitrogen supply, than simple peat.

It is therefore evident that leather is not of sufficient worth as a fertilizer to have a commercial value put upon it for that purpose. Nevertheless, just as the nitrogen of peat may be brought into an available condition by composting with alkaline matters, so that of leather may be transformed, in part at least, into plant-food, and by similar means.

If leather chips be boiled in a strong potash-lye, ammonia is given off copiously, and while the farmer cannot use this fact as a method of utilizing leather, he may no doubt safely infer from it that leather chips are a serviceable ingredient of the compost, in which on the one hand, urine and ammonia-yielding animal matters, or, on the other, lime and ashes or salt and lime are ingredients. In the ordinary compost, leather chips require a long time, a year or so, to become properly disintegrated. The oil in leather hinders the penetration of water and thus opposes decay. Drenching the leather with a moderately strong potash-lye, which dissolves the oil, would therefore appear to be a useful preliminary in composting it, but the question how far such expedients can be economically resorted to on the farm, is one that experience can only determine.

By heating leather chips mixed with alkali (lime and soda) to redness, all the nitrogen may be extracted in the form of ammonia, and it is perhaps not improbable that this process might be carried out on a manufacturing scale with a profit, where leather refuse is largely accumulated.

APPLE POMACE.

The question whether Apple Pomace has any fertilizing value has been proposed to the Station, and a sample was received from D. H. Van Hoosear, of East Wilton. Since Prof. F. H. Storer has examined this material, it appeared unnecessary to analyze the sample. Practical trial has established that there is very trifling fertilizing value in apple pomace, and the analysis sustains and explains this view. Prof. Storer found in it as made from Baldwin apples:*

Water,	77.21
Organic matter,†	22.29
Ash,	.50
	100.00
† With nitrogen,	.16

The ash is nearly half potash. The organic matter consisting mainly of carbhydrates, might be serviceable in a compost, in the same sense that the organic matter of swamp muck or saw dust may be, but evidently there is nothing in the apple pomace to justify much handling of a material which consists so largely of water.

SOILS.

Detailed analyses of four samples of soil have been made in the hope of learning the causes of their unproductiveness. A sample of clay has also been examined.

489 and **490** are samples from adjoining fields belonging to the farm of D. H. Van Hoosear, president of the Wilton Farmers' Club. Both are what would be termed sandy loams with sufficient vegetable matter to give them a rich dark appearance when wet. The subsoil is sandy or loamy. They are said not to need draining, are not shaded, and there is no apparent reason why the soil whence these samples were taken should not be as good as the surrounding land, which is in part remarkably productive. Mr. Van Hoosear states that **489** during fourteen years of his ownership has been manured heavily, but all crops, grass, grain, corn, potatoes, have not been up to standard. As to **490** he says that during forty years he has not been able to get a good crop, although all crops have been tried, with heavy applications of stable manure, and as the land was light cattle have been foddered on it to make it more compact, but this has been of no avail.

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* Bulletin of the Bussey Institution, vol. I, p. 365.

In order to appreciate the analytical results we must compare them with the composition of soils of known character for fertility. In the Table, page 70, are given analyses of two soils, one a naturally poor sandy loam made capable of yielding a ton of tobacco per acre by copious manuring, the other a naturally fertile prairie soil. The former was analyzed by Dr. C. U. Shepard, Jr., State Chemist of South Carolina, to whom I am indebted for the valuable series of papers in which it was published. The latter was analyzed by Dr. Voelcker, Chemist to the Royal Agricultural Society of England, and is copied from Caird's "Prairie Farming in America." The analyses were all made, I believe, by essentially the same method and are fairly comparable.

The analysis of the soil and its hydrochloric solution as given on page 70, totally fails to give any explanation of the infertility of **489** and **490**. Notwithstanding these soils with 12 and 8 per cent. of water are compared with the nearly or quite dry tobacco and wheat soils, they surpass the tobacco soil in organic matters, in nitrogen, in potash, in soda, in magnesia, and in sulphuric acid. **489** surpasses the tobacco soil in lime and contains nearly as much phosphoric acid. **490** has indeed less lime but has more phosphoric acid than the tobacco soil. **489** and **490** surpass the prairie soil in quantity of organic matter, of potash, soda and magnesia. Both contain less lime and sulphuric acid, **489** has a little less phosphoric acid and nitrogen, **490** has half as much nitrogen but more phosphoric acid than the prairie soil.

Some years ago M. Grandeau studied the composition of certain soils which possessed very different productive powers but which by the usual method of chemical analysis (of the acid solution) gave similar results. He found, however, that, after removing carbonates by a very dilute acid, and treating the residues with ammonia, solutions were obtained in which potash, phosphoric acid, etc., together with a black organic matter, or humus, "*matière noire*," were present in quantity corresponding to the fertility of the soil.

Grandeau has in fact been led by these studies to adopt the theory that in fertile soils generally the presently available plant-food exists in combination with humus, and that in the ammonia extract of a soil we have a comparatively ready and certain measure of its fertility. Since these soils from E. Wilton contain a large proportion of organic matter, it was decided to examine them after the method of Grandeau, and the table on page 71 gives the results, where they may be compared with Dr. Shepard's analysis by the same method of the N. Hadley tobacco soil.

It is seen that **489** and **490** yielded as much or more ammonia extract than the tobacco soil, and that the amounts of potash extracted were quite the same, but that there was in comparison to the tobacco soil a decided deficiency of lime and magnesia.

Without at once concluding that Grandeau's notion of the value of the analysis of the ammonia-extract is correct applied to these soils, it certainly would be interesting to try upon them moderate applications of lime either caustic or air-slacked. If the result were favorable it would go to sustain Grandeau's theory.

I should add that no traces of poisonous ingredients—soluble iron-salts—could be found.

Sample **493** was received from Hon. T. S. Gold, Secretary of the Board of Agriculture, who gives the following history of it:

"The earth which I send you was taken from the surface soil where formerly stood an old stable which was kept full of cows every winter for some fifty years. The stable was removed in the spring of 1878, and the manure which had accumulated under the stable-floor taken away down to the loamy soil. The place has been exposed to the weather for over two years yet nothing grows upon it. This sample was taken in September, after a rain which wet down some six inches, the season having been rather dry. At the depth of two or three feet we find hardpan, so there could not be much leaching, and as the spot is nearly level not much washing could take place. We have always found the earth from under old buildings which have contained cattle a powerful fertilizer, but expected the rains of two years would reduce its strength so that it would allow something to grow.

Some twenty years ago I cleared away another old stable and there observed the same barrenness for several years. Now the spot cannot be determined by its vegetation."

493 manifests, by the analysis of its acid solution, no deficiency of any mineral element. Its ammonia-extract however, page 71, contains but little lime and magnesia. What perhaps explains its present infertility is the comparative absence of nitrogen. This extremely interesting fact is the more surprising because the soil has been during the winters of half a century constantly charged

ANALYSES OF SOILS.

Solution in hydrochloric acid.

	Well manured tobacco soil, North Hadley, Mass.	**489** E. Wilton, Ct.	**490** E. Wilton, Ct.	**493** W. Cornwall, Ct.	**503** East Hartford, Ct.	**491** E. Wilton, Ct.	Best wheat soil, Illinois.
Moisture,	1.096	12.100	8.380	13.200	10.715	.840	Dried
*Organic and volatile matters,	2.763	8.350	6.000	2.140	4.050	1.850	5.688
†Potash,	.037	.122	.100	.775	.048	.417	.043
†Soda,	.025	.074	.054	.053	.035	.062	.012
†Lime,	.188	.253	.117	.295	.040	.180	.505
†Magnesia,	.205	.513	.513	.493	.092	.404	.042
†Oxide of iron and alumina,	1.701	4.978	5.401	5.320	2.116	5.466	3.575
†Sulphuric acid,	.031	.043	.031	.022	.056	.005	.134
†Phosphoric acid,	.219	.178	.285	.203	.295	.091	.232
Carbonic acid and chlorine,	.011	....	....	....	....	....	.235
Sand, silica and insoluble silicates,	93.724	73.389	79.119	77.499	82.553	90,685	89.471
	100.000	100.000	100.000	100.000	100.000	100.000	100.000
*Containing nitrogen,	.103	.264	.167	.061	.103	*trace*	.300‡

† Soluble in cold hydrochloric acid. In case of **489** to **491** the acid was applied for the time and of the strength directed by Wolff. The same I suppose is true of the other soils.

‡ In this analysis nitrogen was not determined: the figure given is the average found in several similar soils by Dr. Voelcker.

ANALYSES OF SOILS.

Ammonia-extract.

	Well manured tobacco soil, North Hadley, Mass.	489	490	492
Humus in ammonia extract	1.000	2.190	1.633	.072
Ash " " "	.319	.344	.293	.556*
Containing:				
Silica,	.039	.042	.031	.142
Oxide of iron and alumina,	---	.179	.148	.222
Lime,	.035	.005	.003	.009
Magnesia,	.119	trace	trace	.004
Potash,	.007	.009	.008	.032
Phosphoric acid,	.097	.083	.059	.098
Sulphuric acid, soda, &c., by difference,	.022	.026	.044	.049
	.319	.344	.293	.556
Total ammonia extract (*matiére noire*),	1.319	2.534	1.926	.628

* The ammonia extract contained much fine clay which could not be separated by filtration.

with cattle urine, and unless some special cause existed for the dissipation of this element, the sample should contain much more nitrogen than is commonly found in soils.

The very natural supposition that the barrenness of this earth is due to an excess of soluble plant-food, would appear from the analysis to be the reverse of true. The soil as analyzed is rather unproductive from deficiency than from surplus of nitrogen; probably there is deficiency of presently available lime.

The soil was tested for poisonous salts and a very minute trace of protosulphate of iron was detected, but the proportion was altogether too insignificant to affect vegetation. Evidently the carbonate of ammonia which results from the decay of urine has acted upon the original organic nitrogen of the soil and rendered it soluble just as we have seen that lime acts on the nitrogen of peat. The soluble matters have leached away through the clay subsoil doubtless because of the physical effect which dissolved salts have in coagulating clay and rendering it penetrable. Not only has nitrogen thus disappeared, but the carbonate of ammonia has carried off in solution a large share of the humus originally present and with it the alkalies and other plant-food which are found in Grandeau's ammonia-extract. The soil illustrates in its present barrenness the effects of too much saline and ammoniacal manures, and serves perhaps to explain the exhaustion which has been observed to follow a too heavy course of Peruvian Guano.

This soil—which has resulted from the disintegration of granitic rocks and exhibits abundance of feldspar and mica—is naturally rich and will shortly recover a good supply of the ash-elements of plant-food by the weathering of its minerals. It would seem that the spot whence the sample came needs nothing but nitrogen in order to become again productive in a year or two.

It is, however, possible that the soluble saline matters which we should expect to find in a soil that has been so liberally manured with urine, have been merely washed into the subsoil by the heavy rain which fell just before the sample was taken, and would, on recurrence of dry weather, ascend with the evaporating water to the surface, and accumulate there in quantity sufficient to injure vegetation.

The sample **503** is from a spot in a tobacco field, the property of Mr. George Abbey, of East Hartford, which is stated to be unproductive notwithstanding various and copious manurings. The plants are said to do well for a time after setting out, but in a few weeks become discolored and blighted and shortly perish. The soil contains no poisonous salts. The analysis of the acid solution reveals no deficiency except perhaps that of lime. Nitrogen is present in fair proportion. The sample supplied was not sufficient for studying the ammonia-extract. As I informed Mr. Abbey before undertaking the analysis, the failure of the tobacco plants as he described it pointed rather to a physical than a chemical difficulty. The blight is such as would result from a failure of water supply which might be due either to a bed of hardpan or of open gravel at a little depth.

491 is a sample of "clay" sent by D. H. Van Hoosear with regard to which the question was raised whether it would have any value as a fertilizer. As a soil it is seen to be rather rich in potash but is destitute of nitrogen and deficient in phosphoric acid. It has in fact nothing to recommend it as a fertilizer, although it might be useful to amend the texture of a coarse leachy soil. It is not, in fact, strictly speaking, a clay, i. e., it contains no considerable amount of those exceedingly fine matters which confer plasticity on clays, but is merely a fine silt or sand.

The analyses of Connecticut soils hitherto made show, as might be predicted from a knowledge of the rocks and minerals whence they are derived, that they commonly contain abundance of potash derived from the feldspar of our rocks and of magnesia coming from the mica (or isinglass) which is found in our granites and schists. Lime though not entirely deficient in most cases is not abundant, as is further evidenced by the fact that the water of our streams and springs is commonly soft. Whether or not these elements exist in presently available condition depends upon the texture of the soil, the supply of humus and the cropping they have been subjected to.

FLORIDA MAGNESIAN LIMESTONE.

A sample of limestone from Orange County, Florida, was sent to the Station by Charles E. Lord, Secretary of the Farmers' Club at Chester, who writes: "Several of our towns-people are interested in Orange groves in Florida, and would be pleased to learn your opinion of the fertilizing value of this rock, which is found there in large quantities, and could be got out and transported at about the same cost as the gypsum of Nova Scotia. Would it be valuable as a top-dressing about orange trees, and would it compare with gypsum and wood ashes as an application to onions?"

The analysis of the rock gave the subjoined result:

Silica and matter insoluble in acids,	9.89
Iron oxide,	trace
Lime,	29.99
Magnesia,	9.98
Potash,	0.16
Soda,	0.41
Sulphuric acid,	0.36
Phosphoric acid,	0.95
Chlorine,	trace
Carbonic acid and water (by difference),	48.26
	100.00

The rock consists accordingly, in round numbers, of:—

Carbonate of lime,	52	pr. ct.
Carbonate of magnesia,	21	
Phosphate of lime,	2	
Sulphates and carbonates or silicates of potash and soda,	1	
Silica, sand and insoluble matters,	10	
Water,	14	
	100	

The rock is a magnesian limestone. Its phosphate of lime would be worth, commercially, $1.00 per ton of the pulverized rock. The alkali-salts are present in too small quantity to have much effect on the fertilizing value. On soil deficient in lime and magnesia, this rock, either pulverized or burned, would under judicious application, in connection with organic matter, make a serviceable fertilizer. Since lime is the chief ash-element of all trees, a top-dressing of the pulverized or of the burned rock, after air-slacking, would probably be of benefit to orange trees. It can hardly be an efficient substitute for gypsum and wood ashes, applied to onions.

FODDER AND FEEDING STUFFS.

Seventeen samples of Feeding Stuffs have been analyzed, viz:

9 of maize; 2 of meal, and 7 of kernel.
2 of hay.
2 of wheat flour.
2 of cotton seed meal.
1 of dried brewers' grains.
1 of vegetable-ivory dust.

Besides the above, *Bowker's Bone Meal for Cattle* has been examined, and already noticed under Fertilizers, see p. 31, where its valuation is considered.

As in former Reports, I give here a few pages explanatory of the analysis of Fodder and Feeding Stuffs. The recent publication of Dr. Armsby's *Manual of Cattle Feeding*,* enables me to refer to that book for further information on these and other points connected with the composition and use of feeding stuffs.

It is chiefly owing to the investigations that have been carried on in the European Experiment Stations, that the chemical analysis of an article of cattle food may be usefully employed in fixing its nutritive value and place in the feeding-ration, and also in deciding how much the farmer can afford to pay for it, or at what price, and to what extent he can substitute it for other materials customarily used.

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* Manual of Cattle Feeding, a Treatise on the Laws of Animal Nutrition and the Chemistry of Feeding Stuffs in their application to the Feeding of Animals. With Illustrations and an Appendix of useful Tables. By HENRY P. ARMSBY, Chemist to the Connecticut Agricultural Experiment Station. New York: John Wiley & Sons, 15 Astor Place. 1880.

In order to make our analyses of cattle feed directly useful, it is needful to adduce some of the results of the prolonged study of this subject made in other countries.

The following Table of the Composition and Contents of Digestible Nutritive Ingredients and Money Value of some of the most important Feeding Stuffs (page 78), is taken from the German of Dr. Emil Wolff, of the Agricultural Academy at Hohenheim, and represents the most recent and most trustworthy knowledge on these subjects.*

The *composition* of feeding stuffs, as here stated, is the *average* result of the numerous analyses that have been made within twenty-five years, mostly in the German Experiment Stations.

In his Manual, Dr. Armsby has adopted the Table of Kühn, who gives essentially the same averages as Wolff, and in addition shows the range of composition by stating the greatest and smallest per cent. of each ingredient.

The *quantities of digestible nutrients* are partly derived from actual feeding experiments, and are partly the result of calculation and comparison.

The percentage of the *three classes* of digestible matters, viz: *Albuminoids*,† *Carbhydrates*‡ and *Fat*, form the basis of calculating the money value of feeding stuffs. The values attached to them by Dr. Wolff are the following, the German mark being considered as equal to twenty-four cents, and the kilogram equal to 2.2 pounds avoirdupois.

1 pound of digestible albuminoids is worth 4⅛ cents.
1 " " fat " 4⅛ "
1 " " carbhydrates " $\frac{9}{10}$ "

These figures are intended to express the average *money values* of the respective food-elements in the German markets. Whether or not these values are absolutely those of our markets, they represent presumably the *relative* values of these elements, approximately, and we may provisionally employ them for the purpose of comparing together our feeding stuffs in respect to money value.

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* From "*Mentzel u. Lengerke's Kalender*," for 1879.

† The Albuminoids here include a proportion of *amides* whose quantity in feeding stuffs has very recently become a subject of investigation, and whose nutritive value is not yet fully understood.

‡ The "nitrogen free extract" (N. fr. Extract) in grains consists almost exclusively of carbhydrates, viz: starch, sugar, gum, and allied bodies; in grass and hay it includes, in addition, substances of whose properties we are ignorant but which, so far as they are *digestible*, rank with the carbhydrates.

These money or market values are to a degree independent of the feeding values. That is, if of two kinds of food, for example, Hungarian hay and malt sprouts, the one sums up a value of 66 cents, and the other a value of $1.31 per hundred, it does not follow that the latter is worth for all purposes of feeding twice as much as the former, but it is meant that when both are properly used, one is worth twice as much money as the other. In fertilizers we estimate the nitrogen of ammonia salts at 22½ cents per pound, and soluble phosphoric acid at 12½ cents, but this means simply that these are equitable market prices for these articles, not that nitrogen is worth twice as much as soluble phosphoric acid for making crops. In the future more exact valuations may be obtained from an extensive review of the resources of our markets, in connection with the results of analyses of the feed and fodder consumed on our farms.

The column headed "nutritive ratio" in the table on page 78 gives the proportion of digestible albuminoids to digestible carbhydrates inclusive of fat.* The albuminoids, which are represented in animal food by the casein or curd of milk, the white of egg and lean meat, and in vegetable food by the gluten of wheat (wheat gum), and other substances quite similar to milk-casein and egg-albumin, have a different physiological significance from the carbhydrates, which are fiber or cellulose, starch, the sugars, the gums, and similarly constituted matters.

The albuminoids may easily be made over by the animal into its own substance, i. e., into muscles, tendons, and the various working tissues and membranes which are necessary parts of the animal machine, because they are the same kind of materials, are, chemically speaking, of the same composition.

The carbhydrates, on the other hand, probably cannot serve at all for building up the muscles and other parts of the growing animal, and cannot restore the waste and wear of those parts of mature animals, because they are of a very different nature. They contain no nitrogen, an element which enters into all the animal tissues (albuminoids) to the extent of some fifteen per cent. of their dry matter.

The carbhydrates cannot restore the worn out muscles or membranes of the animal any more than coal can be made to renew the used-up packing, bolts, valves, flues and gearing of a steam-engine. The albuminoids are to the ox or the man what brass and iron are to the machine, the materials of construction and repair.

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* Fat and carbhydrates have, it is believed, nearly the same nutritive function, and it is assumed that 1 part of fat equals 2.4 of carbhydrates.

The carbhydrates are, furthermore, to the animal very much what coal and fuel are to the steam-engine. Their consumption generates the power which runs the mechanism. Their burning (oxidation) in the blood of animals produces the results of life just as the combustion of coal in the fire-place of the steam-engine produces the motion and power of that machine.

There is, however, this difference between the engine and the animal. The former may be stopped for repairs, the latter may run at a lower rate, but if it be stopped it cannot resume work. Hence the repairs of the animal must go on simultaneously with its wastes. Therefore, the material of which it is built must admit of constant replacement, and the dust and shreds of its wear and tear must admit of escape without impeding action. The animal body is as if an engine were fed with coal and water not only, but with iron, brass and all the materials for its repair, and also is as if the engine consumed its own worn out parts, voiding them as ashes or as gas and smoke. The albuminoids, or blood- and tissue-formers, are thus consumed in the animal, as well as the carbhydrates, or fuel proper. The fact that the albuminoids admit of consumption implies that when the carbhydrates or proper fuel are insufficient, they, the albuminoids, may themselves serve as fuel. Such is the case, in fact. But, nevertheless, the two classes of substances have distinct offices in animal nutrition, and experience has demonstrated, that for each special case of animal nutrition a special ratio of digestible albuminoids to digestible carbhydrates is the best and most economical, and, within certain limits, is necessary. This proportion we designate as the *nutritive ratio*, and these explanations make its significance evident.

To allow of directly comparing the money-value of feeding stuffs with some universally accepted standard, the last column of the table (page 78) gives a comparison with good average meadow hay taken as 1.

Average Composition, Digestibility and Money Value of Feeding Stuffs as given by Dr. Wolff for Germany for 1879, *except those in italics.*

	Water.	Ash.	Nitrogenous Matters, Albuminoids & Amides.	Fiber.	Nitrogen-free Extract.	Fat.	Digestible nutrients.			Nutritive Ratio.*	Value.	
							Albuminoids.	Carbhydrates including fiber.	Fat.		Dollars per 100 pounds.	Comparison with meadow hay = 1.
Meadow hay, poor	14.3	5.0	7.5	33.5	38.2	1.5	3.4	34.9	0.5	10.6	0.48	0.74
" " fair	14.3	5.4	9.2	29.2	39.7	2.0	4.6	36.4	0.6	8.3	0.55	0.86
" " average	14.3	6.2	9.7	26.3	41.4	2.5	5.4	41.0	1.0	8.0	0.64	1.00
" " very good	15.0	7.0	11.7	21.9	41.6	2.8	7.4	41.7	1.3	6.1	0.74	1.17
" " extra	16.0	7.7	13.5	19.3	40 4	3.0	9.2	42.8	1.5	5.1	0.84	1.32
Clover hay, average	16.0	5.3	12.3	26.0	38.2	2.2	7.0	38.1	1.2	5.9	0.69	1.08
" " best	16.5	7.0	15.3	22.2	35.8	3.2	10.7	37.6	2.1	4.0	0.88	1.39
Timothy hay	14.3	4.5	9.7	22.7	45.8	3.0	5.8	43.4	1.4	8.1	0.69	1.09
Hungarian hay	13.4	5.7	10.8	29.4	38.5	2.2	6.1	41.0	0.9	7.1	0.66	1.04
Rye straw	14.3	4.1	3.0	44.0	33.3	1.3	0.8	36.5	0.4	46.9	0.35	0.55
Oat "	14.3	4.0	4.0	39.5	36.2	2.0	1.4	40.1	0.7	29.9	0.44	0.69
Rich pasture grass	78.5	2.2	4.5	4.0	10.1	1.0	3.4	10.9	0.6	3.6	0.27	0.42
Average meadow grass, fresh	70.0	2.1	3.4	10.1	13.4	1.0	1.9	14.2	0.5	8.1	0.22	.36
Green maize, German	85.0	1 0	1.2	4.7	7.6	0.5	0.7	7.4	0.2	11.3	.10	.16
" *Mr. Webb*, 1874	86.0	0.8	0.8	4.8	7.3	0.3	0.6	8.3	0.2	14.4	.11	.17
Cured Maize Fodder, Mr. Webb	27.3	4.2	4.4	25.0	37.9	1.3	3.2	43.4	1.0	14.4	57	.91
Potatoes	75.0	0.9	2.1	1.1	20.7	0.2	2.1	21.8	0.2	10.6	.29	.46
Carrots	85.0	0.9	1.4	1.7	10.8	0.2	1.4	12.5	0.2	9.3	.18	.28
Mangolds	88.0	0.8	1.1	0.9	9.1	0.1	1.1	10.0	0.1	9.3	.14	.22
Rutabagas	87.0	1.0	1.3	1.1	9.5	0.1	1.3	10.6	0.1	8.3	.15	.24
Turnips	92.0	0.7	1.1	0.8	5.3	0.1	1.1	6.1	0.1	5.8	.11	.16
Sugar beets	81.5	0.7	1.0	1.3	15.4	0.1	1.0	16.7	0.1	17.0	.19	.30
Maize, German	14.4	1.5	10.0	5.5	62.1	6.5	8.4	60.6	4.8	8.6	1.10	1.73
" *American*	14.4	1.5	10.7	2.0	66.5	4.9	9.0	63.3	3.7	8.0	1.12	1.75
Oats	14.3	2.7	12.0	9.3	55.7	6.0	9.0	43.3	4.7	6.1	.97	1.53
Rye	14.3	1.8	11.0	3.5	67.4	2.0	9.9	65.4	1.6	7.0	1.09	1.68
Barley	14.3	2.2	10.0	7.1	63.9	2.5	8.0	58.9	1.7	7.9	0.95	1.47
Peas	14.3	2.4	22.4	6.4	52.5	2.0	20.2	54.4	1.7	2.9	1.44	2.25
Field beans	14.5	3.1	25.5	9.4	45.9	1.6	23.0	50.2	1.4	2.3	1.51	2.36
Squashes	89.1	1.0	0.6	2.7	6.5	0.1	0.4	7.1	0.1	18.4	.08	.13
Malt sprouts	10.1	7.2	24.3	14.3	42.1	2.1	19.4	45.0	1.7	2.5	1.31	2.06
Wheat bran, coarse	12.9	6.6	15.0	10.1	52.2	3.2	12.6	42.6	2.6	3.9	1.04	1.63
" fine	13.1	5.4	14.0	8.7	55.0	3.8	11.8	44.3	3.0	4.4	1.03	1.62
Middlings	11.5	3.0	13.9	4.8	63.5	3.3	10.8	54.0	2.9	5.7	1.07	1.68
Rye bran	12.5	5.2	14.5	5.7	58.6	4.5	12.2	46.2	3.6	4.5	1.10	1.72
Palm-nut cake	10.5	4.2	16.9	17.4	41.0	10.0	16.1	55.4	9.5	4.9	1.61	2.51
Cotton seed cake decorticated	11.2	7.6	38.8	9.2	19.5	13.7	31.0	18.3	12.3	1.6	2.05	3.22
Scrap, by *Goodale's process*	11.5	----	64.0	----	----	4.6	57.6	----	4.1	0.2	2.67	4.17
Fish-scrap, dry ground	11.7	----	51.5	----	----	8.1	46.4	----	6.2	0.3	2.28	3.56
Dried blood	12.0	4.1	80.8	----	2.6	0.5	54.1	2.6	0.5	----	2.39	3.76
Whey	92.6	0.7	1.0	----	5.1	0.6	1.0	5.1	0.6	6.6	.11	.18
Milk	87.5	0.7	3.2	----	5.0	3.6	3.2	5.0	3.6	4.4	.34	.53

* Nutritive ratios are read, 1 : 10.6, 1 : 8.3, etc. See page 76.

MAIZE.

LXXIII, Maize Meal. Ground by Marsh, White & Co., N. Y. From old western corn. One week in store. From stock of D. B. Crittenden & Co., New Haven. Cost $25 per ton.

LXXIV, Maize Meal. Fresh ground from old New York corn. From stock of N. W. Merwin, New Haven. Cost $25 per ton.

LXXVI, Maize Kernel, "High-mixed." 1879 crop. From stock of N. W. Merwin, New Haven. Cost 65 cents per 56 lbs.

LXXVII, Maize Kernel, new western corn. Crop 1879. From stock of D. B. Crittenden, New Haven. Cost 65 cts. per 56 lbs.

LXXVIII, Maize Kernel, "High-mixed." New crop western corn. From stock of N. W. Merwin, New Haven. Cost 65 cts. per 56 lbs.

All the above were sampled and sent by J. J. Webb, Hamden, Nov. 14, 1879.

LXXIX, King Phillip Corn, 8-rowed (Flint).
LXXX, Common Yellow Corn, 8-rowed (Flint).
LXXXI, Early Scioto Corn (Dent).
LXXXII, White Flint Corn, 8-rowed.

The last four samples were received from Chas. Fairchild, Middletown, Jan. 9, 1880, and were raised in the vicinity of that place, in 1879.

The water-content of market Corn.

The numerous analyses of Indian Corn recently made here and elsewhere, most of which were printed in the last Report of this Station, have been mainly performed on samples which from long storing in heated apartments, had become much more dry than corn commonly is when marketed. Thus Dr. Jenkins found in summing up the results of 63 analyses of American maize, that the amount of water ranged from 6 to 15 per cent., the average being 10½ per cent. In Wolff's tables the average is 14.4, in Kühn's tables 13.7 per cent., the minimum being 7.6, the maximum 22.4 per cent. Dr. C. A. Goessmann, in reporting recently eleven analyses made by himself and six made by Mr. S. P. Sharples, gives them all 10 per cent. of water. In my first Report for 1877, analyses of three samples of corn meal were published which contained, respectively, 12.9, 20.7 and 21.7 per cent. of water. It therefore appeared important to make further examinations of corn as it is offered in the market, in order to learn the quantities of water which belong to the commercial article. In case of the samples whose analyses are herewith given, the water was determined upon the meal or kernel as it reached the Station, and before any moisture then present could be lost by drying. It is seen from the analyses that all the samples, with one exception, contain 15 or more per cent. of water. The meal made from old Western corn and that from old New York corn, as well as the corn raised in this State, that was cured until Jan. 10th, contained an average of 15.6 per cent. One of the samples of "High-mixed New Crop Western," taken Nov. 14th, had 16.4 per cent. In the two other samples examined at the same date, the water averaged 20.45 per cent. These determinations therefore go to indicate that—1, the water in maize kernel and maize meal, as these are found in market, may range from 13 to 22 per cent. 2, well-cured corn and meal contain from 15 to 17 per cent., and 3, new corn and meal are likely to contain 20 to 21 per cent. It is evidently therefore a matter of some importance in large transactions whether, at a given price, corn and corn meal be bought in a slightly or thoroughly cured state. In the two samples of corn meal examined at this Station in 1877, containing respectively 12.9 and 21.7 per cent. of water, if they were sold at the same price, say $1.25 per hundred pounds, the purchaser would get, in the drier sort 87 lbs., and in the damper article but 78 lbs., of actual corn-meal. In the former case this dry matter would cost $1.44, and in the latter $1.60 per hundred pounds. Or were the drier sample worth $1.25 per hundred, the damper one, if otherwise of equal quality, would be worth but $1.12.

Between the samples LXXIII and LXXVI there is a calculated difference of value of 9 cents per hundred lbs., which is mostly due to the larger quantity of water in the latter.

Every farmer is of course aware that there is a difference between new and old corn in the amount of moisture they contain, but the extent of the difference is, I believe, not generally appreciated.

ANALYSES OF MAIZE.

	Maize Meal.		Kernel as sold in market.			Unshelled corn raised in Connecticut.			
	From old Western corn. LXXIII	From old N. Y. corn. LXXIV	High mixed. LXXVI	New Western. LXXVII	High mixed new Western. LXXVIII	King Phillip. LXXIX	Common Yellow. LXXX	Early Scioto. LXXXI	White Flint. LXXXII
Water,	14.56	15.32	20.68	20.22	16.41	15.97	15.77	15.24	16.82
Ash,	1.22	1.47	1.19	1.16	1.25	1.35	1.26	1.28	1.19
Albuminoids,	9.12	8.63	7.83	8.54	8.57	10.31	10.00	8.31	8.94
Fiber,	2.16	1.83	1.65	1.67	1.76	1.37	1.47	1.59	1.32
Carbhydrates,	68.89	68.77	64.95	64.86	68.16	66.50	67.06	69.78	67.84
Fat,	4.05	3.98	3.70	3.55	3.85	4.50	4.44	3.80	3.89
COMPOSITION RECKONED ON DRY SUBSTANCE.									
Ash,	1.43	1.74	1.50	1.45	1.50	1.60	1.49	1.51	1.43
Albuminoids,	10.67	10.19	9.88	10.70	10.25	12.27	11.88	9.80	10.74
Fiber,	2.53	2.16	2.08	2.09	2.10	1.62	1.74	1.87	1.58
Carbhydrates,	80.63	81.21	81.88	81.31	81.55	79.15	79.62	82.34	81.57
Fat,	4.74	4.70	4.66	4.45	4.45	5.36	5.27	4.48	4.68
DIGESTIBLE NUTRIENTS IN AIR-DRY SUBSTANCE.									
Albuminoids,	7.66	7.25	6.58	7.17	7.20	8.66	8.40	6.98	7.51
Carbhydrates,	65.56	65.32	61.66	61.59	64.72	63.02	63.58	66.18	64.26
Fat,	3.20	3.14	2.92	2.80	3.04	3.56	3.51	3.00	3.07
Nutritive ratio,	1 : 9.6	1 : 10.0	1 : 10.4	1 : 9.5	1 : 10.0	1 : 8.3	1 : 8.6	1 : 10.5	1 : 8.7
Estimated value per 100 lbs.	$1.06	$1.05	$0.97	$0.99	$1.03	$1.10	$1.09	$1.03	$1.04

Comparative value of the Corn-Meal and shelled Corn in market.

In the first Report of this Station, the composition of three samples of commercial maize-meal was compared with that of five varieties of unground corn, and it was remarked that the meal was considerably inferior to the corn, containing, on the average, in dry matter, one per cent. less of fiber, two per cent. less of albuminoids, and two per cent. less of fat than the unground maize. It was in order to make further comparisons between commercial meal and corn that the first five analyses above given were carried out in detail.

Comparison of averages (dry matter).

	1877.	1879.		1879.	*Dr. Jenkins'*	
	Commercial	Commercial		Selected	Averages	
	Meal.	Meal.	Corn.	Conn. Corn.	Flint.	Dent.
Fiber,	1.68	2.34	2.09	1.70	1.71	2.10
Albuminoids,	9.75	10.43	10.28	11.17	12.13	11.81
Fat,	3.69	4.72	4.39	4.95	5.77	5.46

From the above table of averages we see that the specimens of corn-meal examined in 1877 were inferior to those of 1879. The commercial meal and corn of 1879 were practically the same in composition. The corn on ear of 1879 contained on the average 0.8 per cent. more albuminoids than the market shelled-corn of the same year, and 1.5 to 1.8 per cent. less than Dr. Jenkins' averages of 31 analyses of flint and 19 of Dent. On the other hand, one of the samples of Connecticut corn of 1879, viz: the early Scioto, contained but 9.8 per cent. of albuminoids and 4.48 of fat, nearly approaching in inferiority the meal of 1877. Doubtless Dr. Jenkins' averages rate maize too high for the commercial standard, because they represent well-matured, selected, sound and clean corn, while the article in the wholesale market includes whatever is merchantable, although sometimes of inferior quality, and not altogether free from cob and other impurities.

Probably our home-raised corn is generally somewhat better than the western shelled-corn, because it is cleaner and drier, and the meal in market is liable to be inferior to both, because of more moisture and impurities, and perhaps also because damaged corn can be worked into it without ready detection.

On choice of varieties.

The four samples from Mr. Fairchild were selected and sent by him with the object to ascertain which kind was most valuable to raise for feed. Mr. Fairchild gave the following data as to weight, &c.:

The bushel or 38 lbs. of ears yielded 31 lbs. corn and 7 of cob, in case of common yellow and white flint, and 30½ lbs. corn in case of King Phillip and early Scioto. One bushel of shelled early Scioto weighed 56 lbs.; one bushel of each of the others weighed 57½ lbs. The early Scioto, which here is the lowest in quality and money value, is, probably, in a favorable climate, more productive than the other varieties, and from the softness of its kernel is perhaps more easily and completely digestible, which fact offsets its less favorable composition. It is not likely that the differences above observed are constant or characteristic of the varieties: very probably they are to a good degree accidental or dependent upon special circumstances attending the growth of these samples. Evidently it would be necessary to compare the composition and the yield of these kinds of corn during several years, as raised on quite similar soils, and under the same conditions of growth throughout, in order to establish any positive superiority of one over the others.

HAY.

LXXXIII, Clover Rowen. First year after seeding. Cut Aug. 21, 1879. From C. S. Gillette, Cheshire. Mostly red clover, with small admixture of weeds and grasses.

LXXXIV, Second cut after seeding. Cut about July 1, 1879. From C. S. Gillette, Cheshire. Mixture of timothy (Phleum pratense) and red top (Agrostis). A few weeds and sedges.

			Water free.	
	LXXXIII.	LXXXIV.	LXXXIII.	LXXXIV.
Water,	17.40	13.12		
Ash,	3.89	4.11	4.70	4.73
Albuminoids,*	13.54	6.91	16.37	7.95
Fiber,	25.86	28.11	31.33	32.35
Nitrogen-free extract,	37.07	45.73	44.90	52.65
Fat,	2.24	2.02	2.70	2.32
	100.00	100.00	100.00	100.00

* Including "amides" =1.85 % in LXXXIII and 0.85 % in LXXXIV.

Digestible Nutrients in Air-dry Substance.

	LXXXIII.	LXXXIV.
Albuminoids, or protein,	8.12	3.59
Carbhydrates,	37.07	45.73
Fat,	1.32	0.99
Nutr. ratio,	1:5.0	1:13.4

Notes to Hay Analyses, by Dr. Armsby.

"The albuminoids of the clover hay (LXXXIII) are higher than the average of German analyses, and about equal to Wolff's 'Very good' Clover Hay. Its crude fiber is, however, relatively high, being about equal to that of Wolff's 'Average,' but lower than the average of all analyses as given by Kühn. The digestibility of protein appears to be largely determined by the percentage of crude fiber, but to be also affected by the percentage of protein. We may therefore assume the albuminoids of this sample to be rather more digestible than in Wolff's 'Average,' but less so than in his 'Very good,' estimating it at 60. For fat we may assume 59, the corresponding coefficient, without serious error. The digestible carbhydrates are represented approximately by the nitrogen-free extract of the analysis.

LXXXIV has about the composition of Wolff's 'Inferior' Meadow Hay, though it is deficient in albuminoids, and we may assume his coefficients for albuminoids and fat, viz: 52 and 49, respectively, while the nitrogen-free extract represents the digestible carbhydrates."

COTTON SEED MEAL.

LXXXV, From stock of Northam & Robinson, Hartford, Ct. Sent by R. E. Pinney, Suffield. Price $25.00 per ton, in 10 ton lots.

LXXXVIII, From stock of C. H. Carrington, Naugatuck. Sent by M. S. Baldwin, Naugatuck. $30.00 per ton.

	LXXXV.	LXXXVIII.
Water,	8.87	8.87
Ash,	6.99	7.34
Albuminoids,	45.00	43.06
Crude Fiber,	4.65	4.83
Nitrogen-free extract,	22.89	23.73
Fat,	11.60	12.17

	Water free.	
	LXXXV.	LXXXVIII.
Ash,	7.69	8.05
Albuminoids,	49.35	47.24
Crude Fiber,	5.11	5.30
Nitrogen-free extract,	25.11	26.03
Fat,	12.74	13.37
	100.00	100.00

Digestible Nutrients in Air-dry Substance.

	LXXXV.	LXXXVIII.
Albuminoids,	33.30	31.86
Carbhydrates,	11.60	12.03
Fat,	10.56	11.07
Nutritive ratio,	1 : 1.1	1 : 1.2
Estimated value per 100 lbs.,	$2.00	$1.97

These samples of Cotton Seed Meal have been already reported on as Fertilizers (Nos. **394** and **402**, p. 36). They agree very closely in composition. Their value, estimated by Wolff's figures, is $40 per ton. The feeding experiments from which the digestibility of cotton seed meal was deduced, were made with a very impure and inferior Egyptian meal, and as Dr. Armsby implies in his Manual of Cattle Feeding, p. 347, it is probable that the digestibility of the pure meal is greater. If that be the fact, then the above estimated value is relatively too low.

Either as Fertilizer or as Cattle Food, cotton seed meal is one of the cheapest articles in the market, and deserves to be used to a much greater extent than it now is. By employing it first in the feeding trough, its fat and carbhydrates are utilized to the best advantage. Thence a large share of its nitrogen, its phosphates and potash pass into and enrich the manure.

WHEAT FLOUR.

LXXXVI, New Process Flour, from Minnesota Spring Wheat. Sent by N. W. Merwin & Co.

LXXXVII, Fine Flour from entire wheat $\mathrm{W}^{\mathrm{W}}_{\mathrm{W}}\mathrm{W}$ brand.

Prepared from same kind of wheat as the preceding sample. Sent by N. W. Merwin & Co.

	LXXXVI.	LXXXVII.
Water,	12.79	12.89
Ash,	0.50	1.44
Albuminoids,	12.31	14.12
Crude Fiber,	0.07	1.22
Nitrogen-free extract,	73.14	68.32
Fat,	1.19	2.01

	Water free.	
	LXXXVI.	LXXXVII.
Ash,	.57	1.65
Albuminoids,	14.12	16.20
Crude Fiber,	.08	1.39
Nitrogen-free extract,	83.86	78.46
Fat,	1.37	2.33
	100.00	100.00

DUST OF VEGETABLE IVORY.

LXXXIX, Refuse of button factory. Sent by M. S. Baldwin, Naugatuck.

	LXXXIX.	Maize Cob, average.	Date Stones, average.
Water,	18.78	9.16	9.27
Ash,	1.08	1.32	1.04
Albuminoids,	3.37	2.22	5.46
Crude Fiber,	7.50	32.04	23.06
Nitrogen-free extract,	68.57	54.85	52.67
Fat,	.70	.41	8.50
	100.00	100.00	100.00

		Water free.	
Ash,	1.33	1.45	1.15
Albuminoids,	4.15	2.44	6.02
Fiber,	9.23	35.31	25.24
Nitrogen-free extract,	84.43	60.35	58.05
Fat,	.86	.45	9.37
	100.00	100.00	100.00

Nothing, at first sight, would appear to be of less value as cattle food, than the so-called vegetable ivory, the fruit of the *Phytelephas*, a tree of South America. Mr. Baldwin writes, however, that "it has been used as feed for cattle. It is claimed that they eat it with great relish, and fatten upon it." The analysis shows it to contain 68½ per cent. of non-nitrogenous extract, which consists largely if not entirely of carbhydrates, the precise nature of which is under investigation. The vegetable ivory resembles maize cob in composition, except that it contains, water-free, 26 cent. less fiber and 24 per cent. more carbhydrates, as well as somewhat more albuminoids and fat.

The vegetable ivory is nearly equalled in its carbhydrates by date stones, which closely resemble it in appearance, hardness and apparent worthlessness as cattle food. The date stones contain, however, 2 per cent. more albuminoids and 8½ per cent. more fat. Date stones, the analysis of which we owe to Prof. Storer,* are, according to the testimony of travelers, made use of, in Arabia and Africa, after pounding and soaking in water, as food for camels, cows and sheep.

The vegetable ivory unquestionably cannot rank high as a cattle food, either because of its abundance or on account of its nutritive quality; it may, nevertheless, be worth economizing, where its dust or fine turnings are to be had, but should evidently be fed in conjunction with cotton seed meal, brewers' grains or other concentrated foods that can supply the albuminoids and fat, in which it is relatively deficient.

KILN-DRIED BREWERS' GRAINS.

Brewers' Grains, i. e., the residue of barley after it has been malted and used for making beer-wort, has long enjoyed a high repute as cattle food, especially for milk cows; and notwithstanding the fresh grains contain an average of 78 per cent. of water, they are much sought after by farmers living within a few miles of the breweries. During the warmer season, however, large quantities sour and spoil before they can be fed. The only plan of saving them hitherto has been by putting them into pits after the manner of ensilage. Recently it has been attempted to make them capable of indefinite preservation and of easy handling by removal of most of the water which not only constitutes three-fourths of their weight when fresh, but renders them so susceptible to damage. The sample whose analysis is herewith given has been thus prepared. This sample was brought to the Station by A. J. Ramsdell, Esq. of New Haven.

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* Bulletin of the Bussey Institution, vol. I, pp. 373–7.

	Kiln-dried Brewers' grains, XCIII.	Oats, average.
Water	2.57	13.7
Ash	3.97	2.7
Albuminoids	20.38	12.0
Crude Fiber	11.79	9.0
Nitrogen-free extract	54.89	56.6
Fat	6.40	6.0
	100.00	100.00

The amount of water above found is perhaps smaller than can well be practically realized on a large scale. On exposure to air, the grains containing but 2½ per cent. of water will no doubt gradually absorb several per cent. of moisture. With even 10 per cent. of water the dried brewers' grains will be, so far as chemical analysis can indicate, equal or superior to any grain or seed commonly used among us as food for animals. They correspond most nearly to oats in their composition, containing the same proportion of fat, a little more fiber and ash and some 8 per cent. more of the most costly and valuable food element, viz. albuminoids. Peas, beans and flax seed are the only seeds raised at the North which contain so much albuminoids. If experience shall show that the drying of brewers' grains can be carried on economically, the process will save a large amount of valuable cattle food from waste.

I understand it is claimed by some that the drying of brewers' grains seriously injures them for feeding purposes. This notion is in agreement with the idea put forward by the partisans of ensilage, some of whom assert that dried corn-fodder is greatly inferior to a corresponding quantity of the same put down as ensilage. In total absence of any exact comparative trials these claims must be regarded as entirely questionable. Without doubt dry brewers' grains may be considered equally nutritious with dry grains of any sort, that correspond to them in chemical composition.

POISONS.

London Purple.

This cheap substitute for Paris Green has been reported to be efficacious as an insecticide. A sample sent by P. M. Augur, Esq., was found to contain 47·3 per cent. of *arsenic acid.* The complete analysis by Prof. Collier shows the arsenic acid to be united to lime. The arsenate of lime is sufficiently soluble in water and in the digestive fluids of animals to act as an effective poison. The London Purple may therefore be regarded as fairly the equivalent of Paris Green for destructive purposes.

The West Avon Poison Case.

On Sunday morning, May 2nd, 1880, eight milk cows belonging to Messrs. Edward Woodford & Son, of West Avon, first began to show loss of appetite and at night refused their customary feed of ground corn and rye. In the *Connecticut Farmer* of May 15, Mr. P. R. Day* relates that on Tuesday he saw the animals standing with arched backs, heads pressing against the fence or over the watering trough, into which they would occasionally put their noses to sip a little and let it drop from their feverish mouths. One was blind and the eyes of all were dull and sunken. There was a profuse flow of urine; the slight bowel discharge was mostly of a dysenteric character.

Among the earlier symptoms were a grunt of pain at each respiration, twisting their jaws, crunching of the teeth, afterwards convulsions, blind running against the fences, then rapid whirling from left to right in a circle, then falling to the ground, with agonizing bellowings, until death supervened. The first death occurred Wednesday afternoon, the second and third Wednesday night, the fourth Thursday morning, the fifth and sixth the same afternoon and night, the seventh Friday night, the eighth Sunday morning, one week from the first appearance of the illness. Dr. Cressy's *post mortem* showed extensive inflammation and corrosion of the mucous membrane of the digestive tract, while all other organs were healthy. The appearances indicated that the animals had swallowed some energetic poison. Portions of stomach- and bowel-tissue—the muscular coats—were brought to the Experiment Station in order to be subjected to examination for poisons. Dr. R. H. Chittenden, Instructor in Physiological Chemistry and Toxicology in the Sheffield Scientific School, made a full analysis but failed to identify any poison. In fact, so long a time had elapsed between taking poison and death and the tissues had been so denuded of the mucous membrane, that there was little hope of finding poison in them. Application was made, May 11, to Dr. Cressy to obtain, if possible, some of the feed which had been given to the cows, and shortly a small quantity of meal was received from the Messrs. Woodford. The meal bin became empty on Monday, May 3, the day after the cows became sick, and was that day replenished. The sample sent to the Station was obtained by nearly emptying the bin of the new feed and carefully gathering up what remained on the bottom and in the corners. In this sample the poison was identified without difficulty as *Oxalic Acid*. It is stated that all the animals which were fed from that bin died as described. Horses, fed on the same kind of feed, but from another box, were unaffected.

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* The statement here given of the symptoms and *post mortem* appearances is condensed from Mr. Day's account.

PARIS GREEN ON CORN-STALKS.

Under date of Sept. 17, Mr. D. C. Spencer of Old Saybrook wrote the Station as follows: "Last Spring I applied Paris Green, mixed with water, to my corn when it was about three to five inches high, to stay the ravages of the army worm. I desire to know whether you have analyzed any corn thus treated, or can inform me if it will now be safe to feed the corn-stalks and husks? If not, will the Station analyze a sample for me?"

Mr. Spencer was requested to forward to the Station a dozen to fifteen stalks taken from different parts of the field. The sample came in good order, well tied up in papers and secured with sacking. The stalks were run through a straw cutter, and all the dust, together with a good portion of the well-mixed cuttings, were examined by Dr. Jenkins for arsenic. No trace of this poison could be found by the processes which serve to detect $\frac{1}{50000}$th of a grain of white arsenic. It thus appears that the Paris Green applied to the young plants had been completely removed by the rain. It has been well established by Dr. McMurtrie that vegetation takes up into its interior no arsenic from the soil with which Paris Green has been mingled in the quantities which are used for destroying insects, a result which is fully confirmed by this examination.

WHAT BECOMES OF THE RAIN-FALL?

Its Evaporation and Percolation.

Inquiry.

Professor S. W. Johnson:

Dear Sir—At a meeting of the Killingworth Farmers' Club last winter, the question was raised whether there was not inconsistency between the teachings of science in regard to the action of water as a distributing agent for the fertilizing elements of manure, and the practice of surface application of manures to fields long in advance of plowing.

The action of water in bringing fertilizing elements from the highway upon fields favorably situated for receiving them was referred to in illustration, and the question in substance was: If water does take up and carry wherever it goes, the valuable elements of manure, must there not be in many situations risk of very serious loss by this practice? The one upon whom it devolved to answer the question was probably not very well qualified for his task. What he said was in substance as follows:

"There is no practicable method of handling manure which does not involve some waste. It decomposes rapidly under ordinary conditions and its valuable elements are volatile or soluble or both. Water which falls upon manure in the field will certainly take up some of its valuable elements and carry them in whatever direction it goes until some stronger force releases them. Gravity will release those held simply in suspension before they get very far. Those held in solution the soil will seize upon and hold if they get within its reach. But where does the water go to? Ordinarily it goes into the soil at or very near the point where it falls. The soil of a cultivated field has many times the absorptive power that the roadbed of a highway has, and while in heavy rains and upon steep hillsides a considerable amount may run off, the percentage is less than would seem and is not ordinarily enough to occasion serious waste or to overbalance the advantages, economical and otherwise, of this method of application."

A wide difference of opinion was developed as to the proportion of rain-fall which escaped from the surface of sloping fields, and upon this point more than any other the question seemed to turn. Upon this point no one present had anything but guesses to offer and the guesses varied widely.

Now my object in writing to you is to ask if any observations have ever been made which give an answer to the question. Where, and how, does the water that falls upon the surface of a cultivated field, during the year, escape? What is its destination, and by what road does it travel? I know of course that the conditions of the question are uncertain and that no answer at once simple and exact can be given, but one that approximates to accuracy would, I think, be interesting and valuable. Should you agree with me in this opinion, I should be glad to have you tell us what is known of the matter through the columns of the *Connecticut Farmer.*

Very truly yours,
J. M. HUBBARD.

Middletown, Ct., May 17, 1880.

*Answer.**

J. M. HUBBARD, Esq.:

My Dear Sir—It is evident that the water which falls upon the soil of a cultivated field partly passes through the soil, partly remains in it, partly evaporates into the air and may partly flow off the inclined surface to a lower level.

To what extent these several modes of disposal affect the rain-fall evidently depends upon a variety of conditions. Among these conditions are the quantity, frequency and rate of rain-fall, the depth and texture of the mass of soil, the texture and state of dryness of the surface of the soil, the presence or absence of growing vegetation, the weather and climate, as they influence evaporation.

The ordinary rain-gauge affords the means of ascertaining how much rain falls on any field. The lysimeter, a rain-gauge filled with soil, first constructed about 80 years ago in England by Dr. Dalton, shows how much water percolates or passes through the soil. The difference is what evaporates from or remains in the soil. The amount of water that remains in the soil at any given moment is ascertained by the loss of weight which a sample undergoes on drying.

The first observations to which I am able to refer, giving comparisons of the rain-gauge and the lysimeter are those made by Mr. Dickinson of Herts, England, of which an account by Josiah Parkes is given in Vol. V. of the Journal of the Royal Agricultural Society of England. Mr. Dickinson made regular daily observations for eight years, from 1836 to 1843 inclusive. His lysimeter was "an open-top cylinder 12 inches in diameter, sunk vertically in the earth, level with its surface, having a false bottom perforated with holes, like a cullender, which supported three feet depth of soil within the cylinder, through which and through the cullender the excess of the rain—or the portion not evaporated—filtered to the close bottom of the vessel" where it was drawn off and measured. This lysimeter "was filled with the soil of the region, *a sandy*, *gravelly loam* and had constantly *grass growing on it.*"

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* Reprinted from the *Connecticut Farmer* with additions.

The average total rain-fall was $26\frac{6}{10}$ inches per annum; of this $11\frac{3}{10}$ inches or $42\frac{1}{2}$ per cent. filtered through the soil so that $57\frac{1}{2}$ per cent. of the rain-fall evaporated from or remained in the soil. In so long a period, we may assume without serious error that the soil at the close of the observations contained as much water as it did at the beginning, and therefore that $57\frac{1}{2}$ per cent. of the rain-fall evaporated from the surface.

But the rain-fall and the evaporation were naturally different from one year to another. The annual rain-fall ranged from 21 to 32 inches, or 2,137 to 3,139 long tons per acre, the annual evaporation was from 43 to 67 per cent. of the rain-fall.

During the six colder months, from October to March inclusive, the average rain-fall was nearly 14 inches; the evaporation was but $3\frac{56}{100}$ inches, or $25\frac{1}{2}$ per cent., the filtration being $10\frac{39}{100}$ inches, or $74\frac{1}{2}$ per cent.

During the six warmer months, from April to September inclusive, the average rain-fall was $12\frac{67}{100}$ inches, of which the evaporation was $11\frac{77}{100}$, equal to $92\frac{9}{10}$ per cent., and the percolation $\frac{9}{10}$ inch, or $7\frac{1}{10}$ per cent. During the warmer months of 1840 and 1841 no percolation took place at all. In 1836 the summer percolation was 17 per cent. of the rather less than average rain-fall.

The results of similar observations made by Dalton (3 years), Greaves (2 years), and Lawes & Gilbert (5 years), in England, gave respectively for the annual percolation 25, 27 and 36 per cent. of the rain-fall which was 26 to 28 inches. Experiments in Switzerland by Maurice (2 years), Risler (2 years), and by Gasparin (2 years) in France, gave the percolation at 39, 20 and 30 per cent. of the rain-fall which was 26 and 28 inches, except in Risler's case where it was 41 inches.

In this country we have the observations of Dr. Sturtevant at

South Framingham, near Boston, and of Professor Stockbridge at Amherst. Dr. Sturtevant observed during two years an annual rain-fall of $43\frac{1}{2}$ inches, and an average percolation of $18\frac{6}{10}$ per cent., through a gravelly loam 25 inches deep covered with growing grass. The percolation in 1876 was $10\frac{8}{10}$ per cent., that in 1877 was $26\frac{4}{10}$ per cent. of the nearly identical rain-fall. Professor Stockbridge's observations extended from May to November inclusive, of the year 1878. They were made on a "very leachy" soil 3 feet deep, the upper 10 inches of which was a sandy loam with intermixed pebbles, underlaid for 14 inches by gravelly loam, beneath which were 14 (?) inches of stones and gravel. The surface was kept bare of all vegetation.

The rain-fall for the 7 months was 25.7 inches, the percolation was 20 per cent. During *the same period* the South Framingham lysimeter received $27\frac{6}{10}$ inches of rain and its percolation was $14\frac{7}{10}$ per cent.

While the per cent. of percolation is greater in England than in this country, the total amounts measured in inches, that penetrate the soil, are not so different in the various countries. The English results of Dickinson were $11\frac{3}{10}$ inches, of Greaves $6\frac{2}{10}$ inches, of Lawes 10 inches, the Swiss figures of Maurice were $10\frac{1}{10}$ inches, of Risler $12\frac{3}{10}$ inches, the French of Gasparin $5\frac{6}{10}$ inches, the American of Sturtevant in 1876 $5\frac{7}{10}$ inches, in 1877 $11\frac{4}{10}$ inches, and those of Stockbridge for 7 months of 1877 $5\frac{14}{100}$ inches. These figures enable us to say that the filtration of water through the lysimeter amounts to from 5 to 10 inches annually with a rain-fall of 26 to 44 inches. The heavier rain-falls are evidently compensated by greater and more rapid evaporation. Evaporation and rain-fall vary within much wider limits than percolation, which is relatively constant.

The greatest amount of percolation usually occurs during the cooler half of the year from October to March inclusive. During the warmer six months the percolation is comparatively small.

Some better idea of the amount of water that falls, percolates and evaporates, per acre, yearly, may perhaps be obtained with help of the fact that 1 inch of rain on an acre of surface, equals 27,154 U. S. gallons or 862 barrels.

Dr. Wollny of the Munich experiment Station for the study of Soils, found that the same calcareous loamy soil exposed to the same rain-fall permitted 38 per cent. of the water to filter through when the surface was bare of vegetation, while but 20 per cent.

percolated when the soil carried grass or clover, the experiment lasting from April 14 to November 18, 1874.

In another series of trials, three soils, namely sand, peat and clay were compared side by side in three conditions, viz: 1, bare of vegetation, 2 in grass, and 3 covered with a layer of horse manure $2\frac{1}{2}$ inches deep. The percolation through these soils was as follows in per cent. of the rain-fall: Bare sand 64, bare peat 44, bare clay 32; grassed, sand 14, peat 9, clay 1; mulched, sand 45, peat 39, clay 49. This experiment lasted from April 23 to October 31, 1875. It shows 1st how superior clay and peat are to sand as mechanical absorbents of water, 2d that vigorous vegetation greatly diminishes the percolation, because the plants take up and exhale large quantities of water, 3d that a *heavy mulch* makes the percolation less than it is in naked sand or peat but increases the percolation in clay.

In 1876 Dr. Wollny made a similar series of observations with sand, peat and clay, both naked and covered with horse manure to the depth of $\frac{6}{10}$ inch. Under this *light mulch* the percolation was somewhat greater, i. e. the evaporation was less than from bare soil. A coating of gravel had the same effect in lessening evaporation and increasing percolation as the mulch.

All the above observations refer to soils with a *level surface.* Some of them, viz., those of Lawes & Gilbert and of Stockbridge, refer to soils in their agricultural state of compactness, i. e. to soils not in any way loosened up below the plow-depth, the undisturbed soil having been *surrounded by* the lysimeter. In the other cases, mostly, the soil was dug away to sink the lysimeter and then filled into the cavity thus made. It being impossible to restore a disturbed sub-soil to its original compactness the observations made under conditions thus differing are not strictly comparable, although they cannot differ very widely.

Again, the very fact that a stratum of soil is undermined for collecting the water that percolates through it, decidedly affects percolation and evaporation,—usually diminishes the percolation and increases evaporation, by breaking the continuity of the porous earth which when continuous sucks down water from the surface when this is the wetter, and sucks up water from the subsoil when that is the wetter, thus limiting the movement of the water of the soil within a narrower range than it naturally would have.

As regards the flow of water from sloping fields there are no measurements extant to my knowledge, and it is evident that the amount of flow must vary indefinitely with the degree of slope and other circumstances. The surface of soil that has long been exposed to drought is difficult to wet, in fact, at first repels moisture, and a "cloud-burst" or sudden heavy rain may flow off in large proportion from a surface of very slight inclination, when the latter has become dust-dry. On the other hand, the water of a slow-beginning but long-continued and more abundant rain may all penetrate the well-moistened surface of a considerable slope.

A gravelly or coarse-sandy surface is always ready to take up the heaviest rainfall. A fine loam, if moist, will swallow rain rapidly, but dry dusty loam imbibes it slowly. Moist peat (swamp muck) or vegetable mold can hardly be overcharged by any rain, but snuff-dry peat, like a dry and shrunken sponge, requires considerable time to recover moisture.

These various results and considerations answer your question as satisfactorily as the facts within my reach permit.

Yours truly, S. W. Johnson.

SEED TESTS.

The Station has not been called upon by consumers to examine any seeds during 1880. That the Station might be of great service to farmers in this way there can be no doubt. It is very common to hear that a crop is lost or half lost because of the poor quality of seed.

On the other hand, some of our dealers are appealing to the Station for information as to the quality of the seeds they purchase, and I give below a summary of results mostly obtained during 1880, in making tests for the trade, with onion, lettuce, and cucumber seeds. In case of onion seeds the tests are classed according to the age of the seed, as well as its variety. Most of these seeds were grown in Connecticut. A number came from Western States, some from California. The samples of onion seed were examined immediately after their arrival at the Station.

The results confirm in a very striking manner the opinion of experienced seedsmen that seeds rapidly deteriorate in quality by keeping. They also show that seeds of the same variety and age may differ in quality by as much as 30 per cent.; this difference depending upon the circumstances of growth, curing and keeping.

In making seed-tests, it is found that a portion of the seeds germinates within a reasonable time, 10–14 days, a second portion becomes soft and dead, and thereupon moulds or decays, while a third usually small proportion remains sound. If the experiment be prolonged these sound seeds either sprout or decay. Dr. Nobbe, who has had the most extensive experience in seed-examinations advises to add to the per cent. of actually sprouted seeds of all perennial forage plants, grasses, clover, etc., one-third that of the seeds that remain sound, implying that, on the average, such a proportion of the ungerminated but sound seeds would germinate under favorable conditions. This sum-total he designates *seed capable of germination.* Most generally in case of onion seed, and other annuals, those seeds which do not germinate within 10–14 days do not germinate at all, but on prolonging the trial gradually soften and decay.

In some few instances with onion seed two years old, the seeds go on sprouting for three weeks or more. Out of twenty instances where the trial of old onion seeds has been prolonged beyond 10–12 days there has been in but four cases additional germination to the extent of 3 per cent. In one of these cases the additional germination amounted to 12 per cent. Evidently the onion seeds which sprout after 10–14 days are of no practical use, as the thinning and weeding processes interfere with their growth. In our Reports, we shall give the per cent. of seed actually sprouted, and in case of perennials, shall add to it one-third of those remaining sound, to obtain the per cent. of "*seed capable of germination*" in the sense advised by Dr. Nobbe.

RESULTS OF SEED TESTS.

BY DR. E. H. JENKINS.

Variety.	Station No.	Seed sprouted (per cent.)	Seed remained sound (per cent.)	Seed rotted (per cent.)	½ sprouted seed germinated in days.	1,000 seeds weigh (grammes.)
Cucumber Seed.						
	62	37.5	0.0	62.5	4	25.95
	63	6.0	0.0	94.0	8	27.99
	64	84.5	0.0	15.5	4	27.49

No. 62 represents the cucumber seed as it came in bulk. Part of the seed appeared good, another part had apparently begun to sprout before it was prepared for market. No. 63 represents the damaged portion. No. 64 that which was apparently undamaged.

Variety.	Station No.	Seed sprouted (per cent.)	Seed remained sound (per cent.)	Seed rotted (per cent.)	½ sprouted seed germinated in days.	1,000 seeds weigh (grammes.)
Onion Seed less than 1 *year old.*						
Wethersfield Large Red.	85	74.0	13.0	13.0	4	----
	86	80.0	3.0	17.0	7	----
	117	89.5	1.0	9.5	less than 7	2.89
	126	88.0	6.0	6.0	5	4.17
Average,		82.9	5.8	11.3	5	3.53
Danvers Yellow,	69	86.8	3.5	9.7	3	4.13
	97	98.0	1.5	0.5	6	----
	98	90.8	5.0	4.2	4	----
	101	92.2	5.5	2.3	4	----
	102	80.3	7.5	12.2	4	----
	109	85.2	8.5	6.3	4	----
	110	97.8	1.5	0.7	4	----
	118	88.5	1.0	0.5	less than 7	2.66
	133	91.3	4.0	4.7	5	----
	134	92.2	4.0	3.8	5	----
	135	87.3	9.0	3.7	5	----
	136	88.5	6.5	2.0	4	----
	55	64.8	11.0	24.2	7	3.59
	58	94.3	2.0	3.7	4	4.05
Average,		88.4	5.0	6.6	4½	3.60
Extra Early Red,	80	82.5	12.0	5.5	4	----
White Portugal,	114	91.8	2.5	5.7	4	----
	115	88.0	7.0	5.0	6	----
	116	89.0	5.5	5.5	4	----
	65	95.2	1.0	3.8	6	3.63
Average,		91.0	4.0	5.0	5	----
White Globe,	113	93.8	2.0	4.2	4	----
	129	89.7	7.0	3.3	4	----
	57	96.0	0.5	3.5	3	3.83
Average,		93.2	3.2	3.6	4	----
Yell'w Gl'be Danvers,	127	88.5	6.0	5.5	5	3.76
Early Red Globe,	84	85.8	7.5	6.7	4	----
Red Globe,	128	86.0	8.5	5.5	6	4.31
Large Red,	131	75.3	18.5	6.2	4	----
	132	85.3	5.3	9.4	4	----
	53	82.3	9.0	8.7	3	3.95
Average,		80.9	10.9	8.2	4	----
Yellow Dutch,	111	80.0	5.0	15.0	4	----
Average of all varieties,		**87.2**	**5.8**	**7.0**	**4**	**3.73**
Onion Seed between 1 *and* 2 *years old.*						
Danvers Yellow,	70	60.5	31.5	8.0	5	3.40
	99	41.8	42.2	16.0	6	----
	100	41.3	35.5	23.2	6	----
	54	55.7	18.0	26.3	7	3.34
Average,		49.8	31.8	18.4	6	3.37
White Portugal,	130	64.5	27.5	8.0	7	----
White Globe,	56	85.2	7.0	7.8	4	3.62
Red Globe,	112	90.5	5.0	4.5	4	----

Variety.	Station No.	Seed sprouted (per cent.)	Seed remained sound (per cent.)	Seed rotted (per cent.)	½ sprouted seed germinated in days.	1,000 seeds weigh (grammes.)
Extra Early Red,	59	64.5	23.5	12.0	4	3.86
Large Red,	52	72.3	18.5	9.2	4	3.73
Average of all varieties,		64.0	23.0	12.8	5.2	3.59
Onion Seed between 2 and 3 years old.						
Wethersfield Large Red,	87	22.0	65.0	13.0	6	----
	88	27.5	64.0	8.5	6	----
	90	18.8	42.5	38.7	6	----
	91	66.2	30.5	3.3	6	----
	96	17.0	56.5	26.5	6	----
Average,		30.3	51.7	12.0	6	----
Danvers Yellow,	71	47.3	48.5	4.2	6	3.51
	106	32.7	57.0	10.3	6	----
Average,		40.0	52.7	7.3	6	----
Average of all varieties,		**33.0**	**52.0**	**15.0**	**6**	----
Onion Seed between 3 and 4 years.						
Wethersfl'ld Large R.,	51	28.0	?	?	7	3.83
Danvers Yellow,	103	1.7	82.5	15.8	10	----
	104	1.8	75.5	12.7	10	----
	107	2.7	32.5	64.8	6	----
Average,		2.1	53.5	34.4	9	----
Extra Early Flat Red,	81	1.8	82.5	15.7	10	----
Average of all varieties,		**7.2**	**68.3**	**24.5**	**8.5**	----
Onion Seed between 4 and 5 years.						
Wethersfield Large Red,	92	0.3	95.5	4.2	10	----
	93	0.5	88.0	11.5	10	----
	94	0.5	91.0	8.5	3	----
	95	0.3	87.5	12.2	10	----
Average,		0.4	90.5	9.1	8	----
Danvers Yellow,	108	0.3	93.0	6.7	10	----
Ex. Early Flat Red,	82	2.0	78.0	20.0	10	----
	83	0.8	84.0	15.2	3	----
Average,		1.0	85.0	14.0	8	----
Average of all varieties,		**0.7**	**88.1**	**11.2**	**8**	----
Onion Seed between 5 and 6 years.						
Danvers Yellow,	105	0.0	92.0	8.0	-	----
Lettuce Seed.						
	119	96.0	0.0	4.0	3	1.31
	120	98.5	0.0	1.5	3	1.10
	122	96.0	2.0	2.0	3	1.00
	123	97.3	2.0	0.7	3	1.43
	124	98 3	1.5	0.2	3	1.36
Average,		97.2	1.1	1.7	3	1.24

The Station's Instructions for sampling seeds, are as follows:

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION,
NEW HAVEN, CONN.

Instructions for Sampling Seeds.

The Agricultural value of seeds intended for Farm and Garden use is learned by examining a small average sample. A weighed amount of seed is taken, the pure seeds are culled out and weighed, foreign matters and especially noxious seeds are identified, the vitality of the pure seed is tested by careful sprouting trials and a report is drawn up of the results.

As the test of germinating power requires some time for its completion, a report on samples sent in cannot be ordinarily expected in less than two weeks.

The examination of *grass-mixtures* can only be undertaken in special cases. It requires a large outlay of time and labor which is not often justified by the results.

In selecting a sample for examination the greatest care should be used to have it represent accurately the whole amount from which it was taken.

1. Mix well together with the hand and arm the contents of the package (bag or barrel) or packages of seed.
2. Take out five or six small handfuls or cupfuls* from various parts of the package, mix these together and take a part of this mixture for the sample.
3. Send of the smaller seeds—red top, white clover, timothy, etc., two (2) ounces; of beets, turnips, red clover, etc., four (4) ounces; of wheat and cereals, and of peas and other legumes, eight (8) ounces.
4. Samples may be sent by mail, or otherwise, prepaid, and should be *plainly labeled* and addressed to

CONN. AGRICULTURAL EXPERIMENT STATION,
New Haven, Conn.

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*(A small cup may be closed with the palm of the hand, forced down to the desired place, then filled and withdrawn).

Seeds sent in for gratuitous examination must be described on the subjoined Form.

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION,
NEW HAVEN, CONN.

Form for Description of Sample.

STATION NO. REC'D AT STATION. 188 .

Each sample of Seed sent for gratuitous examination must be accompanied by one of these forms, with the blanks *below* filled out as fully as practicable.

The filled out Form, if sent with the sample, will serve as a label; but it must be returned in good order for filing in the Station Records.

Send with each sample a specimen of any printed circular, or statement that accompanies the seed or is used in its sale.

Name or label of seed, ...

Name and address of Producer or Importer, ...

Name and address of Dealer from whose stock this sample is taken,

....

Date of taking this Sample, ...

Selling price per pound or bushel,.........................

Known or reputed age of seed, ...

Number of packages from which sample is taken,..............

Quantity of stock which the sample represents,..............

Was sample taken according to Station Instructions, or how?

....

Signature and P. O. address of person taking and sending the sample.

....

....

The results of the examinations are entered in a suitable record book, and are also reported to the parties sending, on forms of which the following is an example.

Report of Seed Test.

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION, NEW HAVEN, CONN., 188 .

Examination of..seed.

Station No. Sender's Mark. Rec'd. 188 .

From ....

Pure seed,..............................per cent. by weight.

Impurities, ...per cent. by weight.

Pure seed sprouted during.......... days. per cent. by number.

Pure seed decayed during .... days. per cent. by number.

Pure seed sound (unsprouted) after... days. per cent. by number.

Of sprouted seed, ½ germinated in... days.

1000 seeds weighed .... grams.

Per cent. value,..

The "per cent. value" of a sample of seed is obtained by multiplying its per cent. (by weight) of pure seed into the per cent. (by number) found, or able, to germinate, and dividing by 100. It refers the number of seeds found, or able, to germinate, from "pure seed" back upon the sample itself, in terms of per cent. In case of *perennials only* it takes account of ½ of the unsprouted sound seeds.

THE DETERMINATION OF PHOSPHORIC ACID IN COMMERCIAL FERTILIZERS.

In the second Report of this Station a volumetric method for the determination of phosphoric acid was described, which, in a number of trials, gave very satisfactory results. Further investigation showed, however, that this method could not be relied upon, because the changes of color which serve to indicate the completion of the reaction are rendered gradual and uncertain by the presence of considerable quantities of either salts of phosphoric or tartaric acid.

Our attention was then turned to the direct precipitation of magnesium-ammonium phosphate in citric solution and in presence of iron, alumina and lime. By an extensive series of trials Mr. Wells found that very good analyses could be made by this method, and he had already learned how to apply it to all the classes of fertilizers that the Station is called upon to analyze, and, together with Dr. Jenkins and Dr. Armsby, had made numerous comparative trials by it and the molybdic method, when we learned from the foreign journals that Dr. Petermann, Director of the Experiment Station at Gembloux in Belgium, had anticipated us.

The method is in our opinion quite accurate enough for the analysis of fertilizers, and is now regularly employed for that purpose in the Station, since its use saves much time and labor.

We owe to Warington * the first employment of citric acid to prevent precipitation of Fe and Al. Spiller † first showed that Ca is also held in solution by ammonium citrate. Brassier ‡ first applied this fact to phosphoric acid estimation, but held that sulphuric acid must be separated in order to get entirely satisfactory results.

Joulie ‖ considered the sources of error in Brassier's method and claimed to have overcome them by use of a solution of magnesium citrate with citric acid. Evidently, however, his plan was a failure.

Ville § had previously described a method based upon Brassier's, but from his own account it was not satisfactory.

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* Jour. Chem. Soc. London, 1863, 304.

† Jour. Chem. Soc. London, 1858, 112.

‡ Ann. de Chim. et de Phys. [4], vii, 355.

‖ Chem. News, xxvii, 228.

§ Compt. Rend., lxxv, 344.

Petermann,* first brought the process into a satisfactory form, but gave no sufficient details of the mode of working.

Brunner† has given a brief account of his experience with the method, which he considers to be satisfactory for technical purposes.

Grupe and Tollens‡ have also published some preliminary studies of the process.

Mr. Wells' experiments were concluded before the two last-named papers were published, and before Petermann's paper was received at the Station. Here follows Mr. Wells' account of his work.

On Determination of Phosphoric Acid in Citric Solution.

BY H. L. WELLS, PH.B.

This investigation covers the following points:—

1. In the precipitation of NH_4MgPO_4 as ordinarily practiced, does NH_4Cl have a solvent action on the precipitate?
2. To what extent does ammonium citrate in solution dissolve NH_4MgPO_4?
3. When ammonium citrate is present, is magnesium citrate thrown down with NH_4MgPO_4 in such quantity as to make it necessary to dissolve and reprecipitate.
4. What effect has $CaSO_4$ in solutions in which NH_4MgPO_4 is precipitated in the presence of ammonium citrate?
5. What effect has $CaCl_2$ in the same case?
6. What effect have ferric salts?
7. What effect have aluminum salts?
8. After deciding on these points and shaping the method accordingly, practical trials were made controlling the determinations by the molybdic method.

In each experiment a measured quantity of a slightly acid solution of Na_2HPO_4 was used whose content of P_2O_5 was determined by precipitating with magnesia mixture and weighing the magnesium pyrophosphate. To this solution was added the quantities of magnesia mixture,§ ammonium citrate and other solutions required and finally an amount of ammonia solution (sp. gr. 0.96) equal to one-third of the previous volume of the liquid. The whole was stirred vigorously several times at intervals of half an hour, more or less, allowed to stand twelve hours, filtered on asbestos, ignited and weighed in Gooch's crucibles.

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* Versuchs-Stationen, xxiv, 327.

† Fres. Zeitschr., 1880, p. 142.

‡ Ber. d. Deuts. Ch. Ges. XIII, 1269.

§ See note on p. 115.

Three different solutions of sodium phosphate were used in these experiments, viz:

100 c.c. of solution I, used in experiments 1–8, precipitated with magnesia mixture gave the following amounts of magnesium pyrophosphate:

	a	.3151 grams.
	b	.3145 grams.
Average		·3148 grams.

100 c.c. of solution II, used in experiments A–H and 9–85, precipitated in a small volume of solution gave:

	a	.2708 grams.
	b	.2714 grams.
Average		.2711 grams.

100 c.c. of solution III, used in experiments 86–140 gave:

	a	.3037 grams.
	b	.3041 grams.
	c	.3034 grams.
	d	.3041 grams.
Average		.3038 grams.

100 c.c. of solution III, precipitated and filtered, the precipitate dissolved in hydrochloric acid and reprecipitated with the addition of a very little Mg. mixture gave

	a	.3034 grams.
	b	.3021 grams.
	c	.3024 grams.
	d	.3031 grams.
Average		.3028 grams.

These results show an average variation of .00035 grams from the mean of all the determinations, or .0007 between the highest and lowest and an extreme variation of .0013 between the highest and lowest. The error of experiment amounts to from one-tenth to four-tenths of one per cent. of the total amount of pyrophosphate.

1. In the ordinary mode of precipitating NH_4MgPO_4 does NH_4Cl have a solvent action on the precipitate?

The results obtained were as follows:

	Magnesia Mixture.	NH_4Cl (total.)	Total volume.	Weight of $Mg_2P_2O_7$.	Per cent.
A	20 cm.^{3}	1.4 grm.	160 cm^3.	.2761 grm.	101.7
B	20	2.8	160	.2702	99.6
C	20	3.9	185	.2709	99.9
D	20	5.3	185	.2704	99.7
E	20	6.4	215	.2703	99.7
F	20	7.8	215	.2700	99.5
G	20	13.9	295	.2701	99.6
H	20	13.9	430	.2703	99.7

A. contained no more ammonium chloride than was present in the magnesia mixture used. The precipitate probably contained magnesium hydrate. Experience has shown that it is necessary to have more ammonia salts present than the magnesia mixture itself contains in order to secure accurate results.

In the other trials the largest error was .5 per cent. of the total amount of phos. acid, showing that the amount of NH_4Cl and the volume of the solution may vary considerably without greatly affecting the result.

2. To what extent does ammonium citrate in solution dissolve NH_4MgPO_4?

In these experiments the precipitated NH_4MgPO_4 was dissolved on the filter in hydrochloric acid, a few drops of Mg. mixture were added and the solution reprecipitated with NH_3. This was done to remove any magnesium citrate which might have come down in the first precipitation.

Following are the results obtained—

No.	Magn. mix.	Citric acid.	Vol.	$Mg_2P_2O_7$ found.	$Mg_2P_2O_7$ required.	Difference grams.	Per cent.
46	15 cm^3.	15 grm.	400 cm^3.	.2668 grm.	.2711 grm.	—.0035 grm.	98.4
47	20	15	400	.2668	.2711	—.0035	98.4
48	40	15	400	.2670	.2711	—.0033	98.5
49	80	15	400	.2680	.2711	—.0023	98.9
50	100	15	400	.2685	.2711	—.0018	99.0
98	20	0	250	.3034	.3028	+.0006	100.2
99	20	0	250	.3027	.3028	—.0001	99.9
100	20	1	250	.3033	.3028	+.0005	100.2
101	20	2	250	.3033	.3028	+.0005	100.2
102	20	5	250	.3029	.3028	+.0001	100.0
103	20	10	250	.3024	.3028	—.0004	99.8
104	20	15	250	.3013	.3028	—.0015	99.5
105	20	20	250	.2980	.3028	—.0048	98.4
106	20	23	250	.2974	.3028	—.0054	98.2
107	20	23	250	.2981	.3028	—.0047	98.4
108	20	23	250*	.3002	.3028	—.0024	99.1
109	20	23	250*	.3019	.3028	—.0009	99.7
110	20	23	500	.3000	.3028	—.0028	99.0
111	20	23	500	.2994	.3028	—.0034	98.5
112	20	23	500	.3013	.3028	—.0015	99.5

* Double the usual amount of ammonia.

Experiments 46–50 show that the presence of 15 grams of citric acid may make the result come considerably too low, but that this tendency is counteracted somewhat by a large amount of magnesia mixture. Experiments 104 and 112 are exceptional.

Experiments 100–107, 110 and 111 show that amounts of citric acid less than 15 grams in 250–500 c.c. of solution have only a very slight solvent action, while larger quantities have considerable effect. 108 and 109 show that this solvent action is almost wholly counteracted by using a larger amount of ammonia.

3. In the presence of ammonium citrate is magnesium citrate thrown down with NH_4MgPO_4 in such quantity as to make it necessary to dissolve and reprecipitate?

In these experiments the precipitate was not dissolved, but was weighed directly.

In the following table the results are arranged according to the amount of citric acid employed. An asterisk signifies that double the usual quantity of ammonia was used.

No.	Magn. mix.	Citric acid.	Vol.	Found.	Required.	Difference.	Per cent.
15	20 cm³.	1 grm.	163 cm³.	.2723 grm.	.2711 grm.	+.0012 grm.	100.5
35	2	1	140	.0262	.0271	—.0009	96.7
36	20	1	164	.0273	.0271	+.0002	100.8
16	20	2	166	.2715	.2711	+.0004	100.2
17	20	2	166	.2719	.2711	+.0008	100.3
34	20	2	400	.2712	.2711	+.0001	100.0
37	20	2	200	.0276	.0271	+.0005	101.8
33	20	3	400	.2702	.2711	—.0009	99.7
18	20	5	315	.2699	.2711	—.0012	99.5
29	80	5	260	.2762	.2711	+.0051	101.8
30	80	5	400	.2778	.2711	+.0067	102.4
31	20	5	180	.2688	.2711	—.0023	99.1
32	20	5	400	.2689	.2711	—.0022	99.1
38	10	5	276	.0274	.0271	+.0003	100.9
39	20	5	400	.0271	.0271	+.0000	100.0
44	80	5	400	.0278	.0271	+.0007	102.6
113	20	7	350*	.3045	.3028	+.0017	100.6
6	20	10	—?	.3151	.3148	+.0003	100.1
19	20	10	200	.2672	.2711	—.0039	98.6
20	20	10	400	.2677	.2711	—.0037	98.8
23	80	10	400	.2725	.2711	+.0014	100.5
27	20	10	300*	.2679	.2711	—.0032	98.9
40	20	10	400	.0274	.0271	+.0003	101.1
41	20	10	400	.0270	.0271	—.0001	99.6
114	20	10	350*	.3023	.3028	—.0005	99.8
7	20	15	...	.3110	.3148	—.0038	98.7
21	20	15	565	.2658	.2711	—.0053	98.0
22	20	15	420	.2664	.2711	—.0047	98.2
24	80	15	400	.2718	.2711	+.0007	100.2
25	20	15	220	.2665	.2711	—.0046	98.3
26	20	15	625	.2677	.2711	—.0034	98.8
28	20	15	330*	.2672	.2711	—.0039	98.6
42	20	15	400	.0268	.0271	—.0003	98.9
43	20	15	400	.0267	.0271	—.0004	98.5
45	80	15	400	.0280	.0271	+.0009	103.3
46	15	15	400	.2668	.2711	—.0043	98.4
47	20	15	400	.2668	.2711	—.0043	98.4
48	40	15	400	.2670	.2711	—.0041	98.5
49	80	15	400	.2680	.2711	—.0031	98.8
50	100	15	400	.2685	.2711	—.0026	99.0
115	20	15	350*	.3006	.3028	—.0022	99.2
116	20	23	350*	.2985	.3028	—.0043	98.5

The experiments in which 7 grams or less of citric acid were used show that such an amount does not seriously affect the accuracy of the result. The two errors already noticed, viz: the precipitation of magnesium citrate and the solution of NH_4MgPO_4 in ammonium citrate very nearly offset each other. Throwing out Nos. 35, 36, 37, 29, 30, 38, 39, and 44, the averages are with 1 gram $\overline{\text{Ci}}$ 100.5 per cent.; with 2 grams 100.3 per cent.; with 3 grams 99.7 per cent.; with 5 grams 99.2 per cent.; with 7 grams (where double the usual volume was employed) 100.6 per cent. Nos. 29, 30 and 44 are not comparable on account of the very large amount of magnesia mixture used. Nos. 35, 36, 37, 38 and 39 contained very small amounts of P_2O_5. The absolute error is small, in these cases, excepting perhaps 35 (where little magnesia mixture was used), quite within the unavoidable errors of experiment, but the percentage error is larger.

Nos. 29, 30 and 44 indicate that with 5 grams of citric acid a very large excess of magnesia mixture (80 c.c.) introduces serious error.

20 c.c. of magnesia mixture is sufficient to precipitate .4 grams P_2O_5, so that in all cases more than twice as much magnesia mixture was used as was absolutely necessary.

Below are tabulated the results of experiments where 10 grams of citric acid were used, arranged according to the volume of solution.

No.	Magn. mixture.	Volume.	Per cent.
19	20 cm^3.	200 cm^3.	98.6
27	20	300*	98.9
114	20	350*	99.8
20	20	400	98.8
40	20	400	101.1†
41	20	400	99·6†
23	80	400	100.5
6	20	?	100.1

Below are tabulated those experiments where 15 grams of $\overline{\text{Ci}}$ were used, arranged according to the volume of solution.

No.	Magn. mix.	Volume.	Per cent.	No.	Magn. mix.	Volume.	Per cent.
25	20 cm^3.	220 cm^3.	98.3	50	100 cm^3.	400 cm^3.	99.0
28	20	330*	98.6	42	20	400	98.9†
115	20	350*	99.2	43	20	400	98.5†
46	15	400	98.4	45	80	400	103.2†
47	20	400	98.4	22	20	420	98.2
48	40	400	98.5	21	20	565	98.0
24	80	400	100.2	26	20	625	98.8
49	80	400	98.8				

* Double the usual amouut of ammonia.

† In these experiments the small amount of P_2O_5 used exaggerates the per cent. error or difference ten times as compared with the others.

These figures indicate that with 15 grams or more of citric acid in solution, the results will be more than 1 per cent. too low unless there is some compensation. A very large excess of magnesia mixture will tend to lessen this error.

Dilution and a larger amount of ammonia also appear to tend in the same direction, but in respect to their influence the results are unsatisfactory.

It will be noticed that the absolute error is much smaller and the percentage error is no larger in those cases where the total amount of P_2O_5 is smaller.

A comparison of these results with those under 2 indicates that nothing is gained by dissolving and reprecipitating the $MgNH_4PO_4$.

4. What effect has $CaSO_4$ in solutions in which NH_4MgPO_4 is precipitated in the presence of ammonium citrate?

The details of the experiments on this point are given below.

No.	Mag. mix. cm³.	Citric acid. grm.	$CaSO_4+2H_2O$ grm.	Vol. cm³.	$Mg_2P_2O_7$ found. grm.	$Mg_2P_2O_7$ required. grm.	Difference ($Mg_2P_2O_7$.) grm.	Ammonia.	Per cent.
51	20	2	.5	240	.2803	.2711	+.0092	½ dil.	103.4
52	20	3	.5	240	.2740	.2711	+.0029	"	101.0
53	20	2	.5	400	.2745	.2711	+.0036	"	101.2
54	20	3	.5	400	.2746	.2711	+.0037	"	101.2
55	20	5	.5	400	.2734	.2711	+.0023	"	100.8
56	20	2	.5	230	.0296	.0271	+.0025	"	109.2
57	20	3	.5	230	.0286	.0271	+.0015	"	105.5
58	20	5	.5	230	.0276	.0271	+.0005	"	101.8
59	20	5	.5	400	.0282	.0271	+.0011	"	103.9
60	20	5	.5	400	.2728	.2711	+.0017	"	100.6
61	20	7	.5	400	.2728	.2711	+.0017	"	100.6
62	20	10	.5	400	.2718	.2711	+.0007	"	100.3
63	20	15	.5	400	.2709	.2711	—.0002	"	99.9
64	20	5	.5	400	.0278	.0271	+.0007	"	102.5
65	20	7	.5	400	.0275	.0271	+.0004	"	101.4
66	20	10	.5	400	.0269	.0271	—.0002	"	99.3
67	20	15	.5	400	.0270	.0271	—.0001	"	99.6
72	20	5	.5	180	.2736	.2711	+.0025	"	100.9
73	20	15	.5	235	.2701	.2711	—.0010	"	99.6
117	20	7	.25	350	.3060	.3028	+.0032	½ conc.	101.0
118	20	10	.25	350	.3052	.3028	+.0024	"	100.8
119	20	15	.25	350	.3040	.3028	+.0012	"	100.4
120	20	23	.25	350	.3020	.3028	—.0008	"	99.7
121	20	7	1	350	.3093	.3028	+.0065	"	102.1
122	20	10	1	350	.3085	.3028	+.0057	"	101.2
123	20	15	1	350	.3053	.3028	+.0025	"	100.8
124	20	23	1	350	.3041	.3028	+.0013	"	100.4

The results in general are high: in all cases where less than 5 grams of citric acid was used with .5 gram $CaSO_4+2H_2O$ they are 1 per cent. or more too high. Where 5 or more grams of $\overline{Ci}$ were employed they were in all cases satisfactory except in 117, 121 and 122, where double the usual quantity of ammonia was employed.

5. What effect has calcium chloride on the precipitation of NH_4MgPO_4 in the presence of $\overline{Ci}$?

The details of the experiments made are given in the following table.

The same results essentially were obtained as with $CaSO_4+2H_2O$, that is: the presence of calcium chloride tends to make the results too high. With more than 10 grams of $\overline{Ci}$ the error was less than 1 per cent. when quantities of calc. chloride were present equivalent to from .25–1.0 grams of calc. sulphate.

No.	Mag. mix. cm³.	$CaCl_2$. grm.	Citric acid. grm.	Vol. cm³.	$Mg_2P_2O_7$ found. grm.	$Mg_2P_2O_7$ required. grm.	Difference. grm.	Ammonia.	Per cent.
125	20	.15*	7	350	.3078	.3028	+.0050	½ conc.	101.6
126	20	.15*	10	350	.3062	.3028	+.0034	"	101.1
127	20	.15*	15	350	.3054	.3028	+.0026	"	100.8
128	20	.15*	23	350	.3028	.3028	.0000	"	100.0
129	20	.6†	7	350	.3106	.3028	+.0078	"	102.6
130	20	.6†	10	350	.3078	.3028	+.0050	"	101.6
131	20	.6†	15	350	.3058	.3028	+.0030	"	100.7
132	20	.6†	23	350	.3032	.3028	+.0004	"	100.1
133	20	.15*	7	350	.0306	.0303	+.0003	"	100.9
134	20	.15*	10	350	.0305	.0303	+.0002	"	100.6
135	20	.15*	15	350	.0308	.0303	+.0005	"	101.6
136	20	.15*	23	350	.0296	.0303	—.0007	"	97.6
137	20	.6†	7	350	.0317	.0303	+.0014	"	104.2
138	20	.6†	10	350	.0313	.0303	+.0010	"	103.2
139	20	.6†	15	350	.0305	.0303	+.0002	"	100.6
140	20	.6†	23	350	.0294	.0303	—.0009	"	97.0

* Equivalent to .25 gr. $CaSO_4+2H_2O$.

† Equivalent to 1 gr. $CaSO_4+2H_2O$.

With large or small amounts of phosphoric acid the results are equally satisfactory.

6. What effect on the precipitation have sesqui-salts of iron?

Following are the details of the experiments—

No.	Mg. mix.	$\overline{Ci}$.	Fe_2O_3.	Vol.	$Mg_2P_2O_7$ found.	$Mg_2P_2O_7$ required.	Diff.	Per cent.
10	20 cm³.	5 gm.	.5 gm.	? cm³.	.2756 gm.	.2711 gm.	+.0045 gm.	101.6
12	20	8	.5	?	.2705	.2711	—.0006	99.8
68	20	5	.5	228	.0284	.0271	+.0013	104.8
69	20	7	.5	400	.0283	.0271	+.0012	104.4
70	20	10	.5	400	.0280	.0271	+.0009	103.3
71	20	15	.5	400	.0270	.0271	—.0001	99.6
74	20	5	.5	400	.2705	.2711	—.0006	99.7
75	20	7	.5	400	.2732	.2711	+.0021	100.7
76	20	10	.5	400	.2710	.2711	—.0001	99.9
77	20	15	.5	400	.2689	.2711	—.0022	99.1

In 10, 68 and 74 the $\overline{\mathrm{Ci}}$ present was insufficient to produce a greenish yellow color; the solutions were red and the precipitates contained iron. In three cases where a small amount of phosphoric acid was present, the results came much too high, and the absolute error was rather too large to be considered due to the errors of experiment. The error decreased as the amount of citric acid increased, and in 71 with 15 grams of $\overline{\mathrm{Ci}}$ the result was satisfactory.

With a larger quantity of P_2O_5 the results came within 1 per cent of the actual amount, with the exception of 10, where 5 grams $\overline{\mathrm{Ci}}$ were used.

7. What effect on the precipitation has the presence of salts of aluminum? Following are the results—

No.	Mg. mix.	$\overline{\mathrm{Ci}}$.	Al_2O_3.	Vol.	$Mg_2P_2O_7$ found.	$Mg_2P_2O_7$ required.	Diff.	Per cent.
9	20 cm^3.	5 gm.	.5 gm.	? cm^3.	.2602 gm.	.2711 gm.	—.0109 gm.	96.0
11	20	8	.5	?	.2681	.2711	—.0030	98.9
13	20	11	.5	?	.2680	.2711	—.0031	98.8
78	20	5	.5	400	.2699	.2711	—.0012	99.5
79	20	7	.5	400	.2702	.2711	—.0009	99.7
80	20	10	.5	400	.2700	.2711	—.0011	99.6
81	20	15	.5	400	.2674	.2711	—.0037	98.6
82	20	7	.5	400	.0275	.0271	+.0006	101.4
83	20	10	.5	400	.0262	.0271	—.0009	96.7
84	20	15	.5	400	.0258	.0271	—.0013	95.2

In general the presence of aluminum salts depresses the results. With .5 grms. Al_2O_3, 5–15 grms. $\overline{\mathrm{Ci}}$, 20 c. c. magnesia mixture, and 400 c. c. total volume of solution, the error falls within 1 per cent.

Summary.

The conditions which tend to introduce a plus error are these:

1. Excessive amount of magnesia mixture in the presence of $\overline{\mathrm{Ci}}$.
2. Presence of calcium as sulphate or chloride.
3. Presence of ferric salts.

The circumstances which tend to make a minus error are:

1. Solvent action of ammonium citrate on $MgNH_4PO_4$.
2. Presence of aluminum salts in the solution.

The most serious error is likely to come from the solvent action of ammonium citrate, and it is to be avoided by increasing the amount of magnesia mixture as the amount of citrate increases, by moderate dilution, and when the amount of citrate is very large (23 grams as in the case of reverted P_2O_5— estimations) by increasing the amount of ammonia employed.

The following quantities of reagents were used in the subjoined analyses of commercial fertilizers.

In case of superphosphates, the analysis by the citric method has sometimes been made on a single portion of 2 grams, which was first washed on a filter with water to extract soluble P_2O_5, then digested with ammonium citrate, as directed by Fresenius, Neubauer and Luck, and "reverted" P_2O_5 thrown down from the solution, and lastly the residue was boiled with HCl, and that solution treated for "insoluble" P_2O_5. In other cases total P_2O_5 has been determined in a separate portion and reverted P_2O_5 obtained by difference.

In case of commercial fertilizers, the presence of calcium salts nearly or entirely compensates the solvent effect of the citrate.

I. *Bones and natural phosphates* (20–30 per cent. P_2O_5).—Use 1 gram substance, 10–15 grams $\overline{\text{Ci}}$, 30–40 c.c. Mg mixture, 350–400 c.c. solution, of which one-quarter is ammonia of specific gravity 0.96.

II. *Superphosphates.* SOLUBLE P_2O_5, 1–2 grams substance, 5–10 grams $\overline{\text{Ci}}$, 20–30 c.c. Mg mixture, 350 c.c. solution.

REVERTED P_2O_5, 1–2 grams substance, 11½ or 23 grams $\overline{\text{Ci}}$, 40 c.c. Mg mixture, and more ammonia than usual.

INSOLUBLE P_2O_5. 2 grams substance, $\overline{\text{Ci}}$, etc., same as soluble.

Comparisons between the Citric and Molybdic methods.

BY MESSRS. WELLS, JENKINS AND ARMSBY.

The results in ( ) are by difference, or in case of total, by addition.

Station No.		By Molybdic method.		By Citric method.		$\overline{\text{Ci}}$ used.	Subst. taken.
345	Sol. P_2O_5,	7.63	7.77 p. c.	7.65	7.70 p. c.	5 gr.	1 gr.
	Insol. P_2O_5,	.92	.94	1.00	.96	5	2
	Total P_2O_5.	9.56	9.57	9.61	9.60	8	.5
348	Rev. P_2O_5,	14.39		14.13	14.46	23	2
	Insol. P_2O_5,	11.52		11.18	11.60	?	
	Total P_2O_5,	25.91		25.80	25.95	?	
351	Sol. P_2O_5,	4.01		3.85	3.93	?	.8
	Insol. P_2O_5,	5.37		5.20		?	1.6
363	Sol. P_2O_5,	4.76	4.89	4.75	4.62	5	.8
	Rev. P_2O_5,	(.51)		.55	.56	23	2
	Insol. P_2O_5,	.43	.46	(.51)			
	Total P_2O_5,	5.91	5.67	5.75	5.78	7	1

Station No.		By Molybdic method.		By Citric method.		$\overline{Ci}$ used.	Subst. taken.
364	Total P_2O_5,	21.12	21.13	20.99	20.95	10	1
365	Sol. P_2O_5,	5.51	5.47	5.42	5.43	5	.8
	Rev. P_2O_5,	(2.13)		2.02	1.98	23	2
	Insol. P_2O_5,	4.39	4.30	(4.52)			
	Total P_2O_5,	11.91	12.02	11.96	11.94	10	1
372	Total P_2O_5,	7.23		7.27	7.28	5	1
373	Sol. P_2O_5,	1.38	1.47	1.28	1.31	5	2
	Rev. P_2O_5,	(3.07)		2.78	2.74	23	2
	Insol. P_2O_5,	.95	.79	(1.11	1.13)*	10	2
	Total P_2O_5,	5.38	5.38	(5.18)			
366	Total P_2O_5,	17.60	17.56	17.57	17.59	12	1
374	Sol. P_2O_5,	1.26	1.20	1.01	.85	5	2
	Rev. P_2O_5,	(7.60)		6.49	6.97†	23	2
	Insol. P_2O_5,	5.40	5.75	(6.46	6.02)	10	2
	Total P_2O_5,	14.40	14.40	(13.90)			
376	Sol. P_2O_5,	10.40			3.18	10	2
	Rev. P_2O_5,				5.45	23	2
	Insol. P_2O_5,				1.35	10	2
					9.98		
377	Sol. P_2O_5,	8.79			2.31	10	2
	Rev. P_2O_5,				5.19	23	2
	Insol. P_2O_5,				1.13	10	2
					8.63		
378	Sol. P_2O_5,	12.38			4.76	10	2
	Rev. P_2O_5,				5.04	23	2
	Insol. P_2O_5,				2.12	10	2
					11.92		
379	Sol. P_2O_5,	11.86			4.08	10	2
	Rev. P_2O_5,				6.12	23	2
	Insol. P_2O_5,				1.24	10	2
					11.44		
380	Sol. P_2O_5,	13.33			4.06	10	2
	Rev. P_2O_5,				2.02	23	2
	Insol. P_2O_5,				7.30	10	2
					13.38		
381	Sol. P_2O_5,	11.17			6.84	10	2 gr.
	Rev. P_2O_5,				1.75	23	2
	Insol. P_2O_5,				2.44	10	2
					11.03		
384	Sol. P_2O_5,	13.96			6.05	10	2
	Rev. P_2O_5,				1.65	23	2
	Insol. P_2O_5,				6.26	10	2
					13.96		
382	Total P_2O_5,	12.97	13.03	13.03	13.05	15	1

* Rev. and Insol. = 3.89 3.87.

† Rev. and Insol. = 12.95 12.99.

Station No.		By Molybdic.		By Citric.		$\overline{Ci}$ used	Subst. used.
383	Total P_2O_5,	27.18	27.20	27.42	27.31	15	1
386	Sol. P_2O_5,	14.21		2.33	2.40		2
	Rev. P_2O_5,			7.25	7.43		2
	Insol. P_2O_5,			4.48	4.20		2
	Total P_2O_5,			(14.05)			2
388	Total P_2O_5,	25.21	25.02	25.04	25.03	15	1
390	Total P_2O_5,	1.79	1.79	1.77	1.77	7	1
393	Total P_2O_5,	7.16	7.19	7.20	7·20	7	1

		Molybdic.	Citric.
427	Total,	26.22	26.26—26.31
440	Total,	24.43	24.40—24.36
422	Total,	22.04	22.16—22.18
443	Total,	21.64	21.94—21.96
442	Total,	19.96	20.04—20.00
434	Total,	19.34	19.57—19.55
430	Sol.,		5.57— 5.56
	Rev.,		1.57— 1.46
	Total,	13.11	13.18—13.15
424	Sol.,		6.03— 5.94
	Rev.,		1.03— 1.16
	Total,	11.28	11.25—11.30
437	Sol.,		6.92— 6.93
	Rev.,		1.11— 1.17
	Total,	10.77	10.81—10.77
433		7.28	7.27— 7.28
421	Sol.,		5.54— 5.63
	Rev.,		0.45— 0.49
	Total,	7.22	7.16— 7.18
423	Sol.,		5.71— 5.76
	Rev.,		.48— .55
	Total,	6.88	6.78— 6.85
439		6.46	6.40— 6.42
435	Sol.,		5.76— 5.67
	Rev.,		.31— .44
	Total,	6.33	6.31— 6.27
417	Sol.,		4.67— ...
	Rev.,		.49— .56
	Total,	5.87	5.87— 5.84
416	Sol.,		2.55— 2.56
	Rev.,		2.01— 2.14
	Total,	5.23	5.54— 5.71
426	Sol.,		3.39— 3.40
	Rev.,		1.59— 1.53
	Total,	6.06	5.94— 5.94
425	Sol.,		2.92— 2.81
	Rev.,		1.59— 1.53
	Total,	4.27	4.26— 4.28
418		1.51	1.35— 1.32

The above comparisons are not a selection, but include all the results obtained up to July, 1880. They were made rapidly and in some cases on material that did not admit of entirely homogeneous sampling. The correspondence of soluble and total P_2O_5, when alike directly determined by the two methods, is in nearly every case satisfactory.

Reverted and insoluble P_2O_5 do not agree so well, as might be expected, because the extraction by ammonium citrate is not without its uncertainties.

Magnesia Mixture.—The mixture used by Mr. Wells was made as follows: 110 grams crystallized $MgCl_2 6H_2O$, 140 grams NH_4Cl, 700 c.c. solution of ammonia sp. gr. 0.96, and water to make one liter. Instead of $MgCl_2 6H_2O$, 27 grams of recently calcined magnesia may be dissolved in the equivalent quantity of HCl, the solution boiled with a little calcined magnesia in excess and filtered.

LAW CONCERNING SALE OF FERTILIZERS.

GENERAL STATUTES OF CONNECTICUT.

REVISION OF 1875.

Title 16, Chapter 15.

SEC. 15. Every package of fifty pounds or more of commercial manure sold, or kept for sale, at over one cent a pound, unless prepared essentially from fish and sold as such, shall be marked with its weight and the name and place of business of the manufacturer, or seller, and with a true analysis of the chemical elements and their several amounts contained therein.

SEC. 16. The Secretary of the State Board of Agriculture may procure the analysis of any fertilizer offered for sale, and prosecute any persons who violate the provisions of the preceding section.

Title 20, Chapter 12.

SEC. 5. Any manufacturer, or trader, who shall sell, or offer for sale, any package containing fifty pounds or more of commercial manure, not marked as required by law, or who shall affix thereto a stamp, impress, or card, claiming that it contains five per cent. more of any fertilizing ingredient than it does in fact, shall forfeit ten dollars for each hundred pounds thereof so offered for sale.

"AN ACT ESTABLISHING THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

"*Be it enacted by the Senate and House of Representatives in General Assembly convened:*

"SECTION 1. That for the purpose of promoting agriculture by scientific investigation and experiments, an institution is hereby established, to be called and known as The Connecticut Agricultural Experiment Station.

"SEC. 2. The management of this institution shall be committed to a Board of Control, to consist of eight members, one member to be selected by the State Board of Agriculture, one member by the State Agricultural Society, one member by the Governing Board of the Sheffield Scientific School at New Haven, and one member by the Board of Trustees of the Wesleyan University at Middletown, and two members to be appointed by the Governor of this State, with the advice and consent of the Senate. The

Governor of the State, and the person appointed as hereinafter provided to be the Director of the Station, shall also be *ex officio* members of the Board of Control.

"SEC. 3. After the appointment of the members of the Board of Control as aforesaid, said members shall meet and organize by the choice from among their number of a President, a Secretary, and a Treasurer, who shall be elected annually, and shall hold their respective offices one year, and until the choice of their successors. Five members of said Board shall constitute a quorum thereof for the transaction of business.

"SEC. 4. Said Board shall meet annually after the first meeting thereof, on the third Tuesday in January in each year, at such place in the city of Hartford as may be designated by the President of said Board, and at such other times and places, upon the call of the President, as may be deemed necessary, and may fill vacancies which may occur in the officers of said Board.

"SEC. 5. Said Board of Control shall locate and have the general management of the institution hereby established, and shall appoint a Director, who shall have the general management and oversight of the experiments and investigations which shall be necessary to accomplish the objects of said institution, and shall employ competent and suitable chemists and other persons necessary to the carrying on of the work of the Station. It shall have power to own such real and personal estate as may be necessary for carrying on its work, and to receive title to the same by deed, devise, or bequest. It shall expend all moneys appropriated by the State in the prosecution of the work for which said institution is established, and shall use for the same purpose the income from all funds and endowments which it may hereafter receive from other sources, and may sue and be sued, plead and be impleaded, in all courts, by the name of The Connecticut Agricultural Experiment Station. It shall make an annual report to the Legislature which shall not exceed two hundred printed pages, of which not exceeding three thousand copies shall be printed.

"SEC. 6. The sum of five thousand dollars annually is hereby appropriated to said Connecticut Agricultural Experiment Station, which shall be paid in equal quarterly installments to the Treasurer of said Board of Control, upon the order of the Comptroller, who is hereby directed to draw his order for the same; and the Treasurer of said Board of Control shall be required, before entering upon the duties of his office, to give bond with surety to the Treasurer of the State of Connecticut in the sum of ten thousand dollars, for the faithful discharge of his duties as such Treasurer.

"Sec. 7. Upon the death or resignation of any of the members of the Board of Control, the authority or institution by which such deceased member was originally appointed shall fill the vacancy so occasioned.

"Sec. 8. Professor Samuel W. Johnson, of New Haven, is hereby empowered to appoint and call the first meeting of said Board of Control as soon as may be practicable after the appointment of the members thereof, and he shall notify all said members of the time and place of said meeting. Two of said members shall hold office for one year, two of them for two years, and two of them for three years; and at said first meeting they shall determine by lot which of said members shall hold office for one year, which for two years, and which for three years. All members of said Board thereafter chosen or appointed, except such as are appointed or chosen to fill vacancies in said Board, shall continue in office for the term of three years from the first day of July next succeeding such appointment.

" Sec. 9. This act shall take effect from its passage.

Approved March 21, 1877."

AN ACT RELATING TO THE PRINTING OF THE REPORT OF THE STATE BOARD OF AGRICULTURE AND OF THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Sec. 1. The Comptroller shall annually cause to be printed, at the expense of the State, five thousand copies each of the report of the State Board of Agriculture and of the Connecticut Agricultural Experiment Station.

Sec. 2. All acts and parts of acts inconsistent herewith are hereby repealed.

Approved, March 19, 1879.

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